2012

Predictors of Attrition and Success in a Weight Management Program for Patients with Type 2 Diabetes

Kevin O'Leary
Philadelphia College of Osteopathic Medicine, kevinoleary@pcom.edu

Philadelphia College of Osteopathic Medicine

Department of Psychology

PREDICTORS OF ATTRITION AND SUCCESS IN A WEIGHT MANAGEMENT PROGRAM FOR PATIENTS WITH TYPE 2 DIABETES

By Kevin O'Leary

Submitted in Partial Fulfillment of the Requirements of the Degree of

Doctor of Psychology

June 2012

PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE
DEPARTMENT OF PSYCHOLOGY

Dissertation Approval

This is to certify that the thesis presented to us by Kevin O'Leary on the 23rd day of May, 2012, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

Committee Members' Signatures:

Stacey Cahn, PhD, Chairperson

Robert A DiTomasso, PhD, ABPP

Anthony Fabricatore, PhD

Robert A DiTomasso, PhD, ABPP, Chair, Department of Psychology

Acknowledgements

I would like to express my gratitude to my advisor and dissertation committee for all their support and guidance. I would like to especially thank Dr. Anthony Fabricatore with whom this study would not have been possible. Dr. Fabricatore not only provided the data for this study, but also guidance, supervision, and support during all parts of this process. He has taught me a great deal about statistical analysis, research, but also provided emotional support and encouragement.

Without the support of the PCOM faculty and fellow cohort, I do not believe that this journey would have been possible. The encouragement and friendship I have received from this extraordinary group of people has helped me to grow into a better professional, as well as a better person.

I would also like to thank my family and friends for sticking with me during this long and arduous process. You have continued to put up with me during the past five years of missed engagements, late night anxious phone calls, and overall stress. Thank you for all the love and support, without which I would not have been able to achieve my goals.

Abstract

Aim: To examine the factors that lead to attrition and success in a weight management program for patients diagnosed with type 2 diabetes. The current study specifically examines the effect of quality of life, expected weight loss, self-esteem, and early weight loss on attrition and success rates.

Methods: Archival data from a study conducted at the University of Pennsylvania Center for Weight and Eating Disorders were used. Seventy-nine overweight and obese subjects with type 2 diabetes participated in a lifestyle modification program over 40 weeks. Logistic regression analyses were performed to explore the relationship between early weight loss, expected weight loss, self-esteem, and quality of life on attrition and success rates in this population.

Results: Subjects who lost the greatest amount of weight at week five, were significantly more likely to achieve a 5% weight reduction at week 40 and were also significantly less likely to drop out of the program before 40 weeks. No significant relationship was found between self-esteem, expected weight loss, and quality of life in this population.

Conclusion: Overweight and obese subjects with type 2 diabetes who show early success in a weight management programs are more likely to stay in the program longer and achieve a significant reduction in weight. Professionals working with this population should encourage early weight loss success (as opposed to concentrating only on long term reductions) as well as provide additional support to patients who are struggling early in the program in order to reduce attrition rates and to increase the likelihood of success.

Table of Contents

List of Tables

Chapter One

Statement of the Problem

Obesity is a major problem in the US and around the world. It is estimated that over 30% of the US adult population is obese (Ogden et al., 2006). Obesity is associated with many co-morbid medical conditions such as cardiovascular diseases, high blood pressure, high cholesterol, knee and joint pain, and type 2 diabetes (Kopelman, 2007). Many of these health problems can be prevented through a reduction in weight (Anderson, Kendall, & Jenkins, 2003).

Diseases such as type 2 diabetes require a great deal of attention. In order to maintain blood glucose in a healthy range, people with type 2 diabetes must limit their intake of carbohydrate, in general, and sugar, in particular. In some cases, patients may need to balance their carbohydrate and sugar intake with oral or injectable medications such as insulin. One of the largest contributing factors to the development of type 2 diabetes is being overweight and being obese. It is estimated that 60 – 90% of the variance in the development of type 2 diabetes in the population can be attributed to obesity (Anderson, Kendall, & Jenkins, 2003). A 5-10% reduction in weight can decrease the risk of developing diabetes and dramatically increase glycemic control in patients already diagnosed with type 2 diabetes (Blackburn, 1995; Klein et al., 2004; Nathan, 2002).

Despite extensive knowledge on weight reduction techniques, weight loss programs continue to suffer from high attrition rates and limited success (Fabricatore et al., 2009; Volkmar, Stunkard, Woolston, & Bailey, 1981). Unfortunately, the factors predicting attrition or success continue to elude researchers. Knowing the factors that lead to success and to attrition can not only assist program developers in identifying patients who may struggle with their weight loss, but also aid them in helping to remedy issues that contribute to attrition before or

during the weight loss program. By determining the factors that contribute to weight loss success and to attrition, treatment providers can alter their programs to increase the rate of success and aid participants in losing more weight. In patients with type 2 diabetes, this may be the key to balancing their blood glucose, leading to a remediation in symptoms and increased control over their illness without the use of costly medications.

Purpose of the Study

The purpose of this study is to examine the factors that lead to attrition or lead to success in a weight reduction program with patients diagnosed with type 2 diabetes. The current study will specifically examine the effect of quality of life, expected weight loss, self-esteem, and early weight loss on attrition and success rates. The data in this study will be extracted from a larger study measuring the effects of a low-glycemic load diet (LGL) versus a low fat diet (LF) for weight loss in a type 2 diabetic population.

Relevance to Goals in the Program

Treatment of overweight and obesity is not only medical, but also psychological. People attempting to lose weight will experience greater difficulty if they are not motivated toward weight loss or feel that they are unable to be successful in following their weight loss plan. Patients with type 2 diabetes who are attempting to reduce their weight will have the additional burden of adjusting their food intake to control their blood glucose. They may also contend with using insulin medications, which may stimulate hunger, increasing the difficulty of staying on a controlled diet.

Research has shown that the longer people are able to follow a specific weight reduction plan, the more success they will have (Perri, Nezu, Patti, & McCann, 1989). Psychologists working with this population consistently search for ways to motivate clients and to keep them

engaged in the weight reduction process. By identifying factors that lead to success and to attrition, weight loss programs and mental health workers can specifically target these factors in order to decrease attrition rates. By accurately identifying issues, the treatment provider can build in safeguards to help reduce the rate of attrition and increase the chance of successful outcomes. This may include working with the patient on issues surrounding motivation, depression, or even added structure and support that will increase their chance of success in losing weight.

Chapter Two: Literature Review

Obesity

Obesity is defined for adults by using a ratio between weight and height commonly known as the body mass index (BMI). For the majority of people, BMI will positively correlate with the amount of fat stored in the body (Centers For Disease Control And Prevention, 2009). BMI, therefore, can be considered an alternative measure of body fat instead of using techniques such as dual energy x-ray absorptiometry (DXA), skin fold thickness measurements, bioelectrical impedance, isotope dilution, or underwater weighing. BMI is calculated by dividing weight by squared height (kg/m^2). A person is considered overweight when his or her BMI is measured at 25 kg/m^2 or higher and is considered obese when his or her BMI reaches 30 kg/m^2 and above (Centers For Disease Control And Prevention, 2009).

Obesity is a major epidemic in the United States (U.S.) and also around the world. The most recent statistics state that over 32.2% of men and 35.5% of women in the U.S. are obese (Ogden et al. 2006). Obesity carries with it many risks and problems. Some of the most common co-morbid health issues with obesity are high blood pressure, high cholesterol, knee and joint problems, various cardiovascular diseases, and type 2 diabetes (Kopelman, 2007).

Emotional Effects of Obesity

Obesity affects mental, as well as physical health. Although some research has demonstrated the idea that obese individuals in the general population display normal psychological functioning, others argue that there is a higher rate of psychological disorders in the obese population. Obesity in itself can serve as a risk factor for later development of depression and related complications (McElroy et al., 2004). This increased risk for the development of depression or other psychological problems increases positively with BMI. A

study by Schowlter et al. (2008) showed significant decreases in Beck Depression Inventory scores as BMI decreased following gastric banding surgery. Younger women with severe obesity (BMI >40) and poorer body image appear to be at the greatest risk for developing depression (Dixon, Dixon, & O'Brien, 2003). This may be due to the increase in health problems and discrimination that occurs with a higher BMI, or due to more internal dissatisfaction because of body image (Fabricatore & Wadden, 2003).

Symptoms of depression in the obese population may increase the risk for further weight gain and for difficulty in losing weight. Murphy et al. (2009) researched how depression differed among obese and non-obese subjects. Findings from this study showed a five-fold increase in overeating during periods of depression in the obese population. This increase in eating behavior made dieting more difficult and has led to a vicious cycle of weight gain and depression. It is estimated that 20-30% of individuals seeking weight reduction suffer from binge eating or depression (Wadden & Phelan, 2002).

The search for a genetic link between depression and obesity has resulted in many contradictory findings. This is in part due to the many mediating and moderating factors of both depression and of obesity. These factors include environmental influences (socioeconomic status, teasing, stress, and food quality), psychological factors such as trauma, or genetic factors such as gender, gene-environment interactions, or even chromosomal differences (Stunkard, Faith, & Allison, 2003). It is hypothesized that although many obese subjects may not meet criteria for a psychological diagnosis, there may be a higher sub clinical level of problems in this population. This includes increases in sub clinical depression, binge eating behavior, anxiety, and stress. These differences may be detected by examining the obese patients' overall quality of life (Fabricatore & Wadden, 2003).

To explore the early connections between obesity and depression, one meta-analysis examined the effect that obesity had on self-esteem and on depression levels on children. Although many studies produced conflicting findings, the overall conclusion was that obesity, depression, and self-esteem were not positively correlated in a community sample. This suggested that obesity is not generally related to depression and to low self-esteem in children.

The analysis did find a higher sub clinical level of depression and of problems with self-esteem in the community sample of overweight and obese children, and found a high correlation of depression and self-esteem issues, but only in the treatment-seeking population. It is difficult to determine whether or not this population was more highly aware of their issues and decided to seek treatment, if they had other co-morbid, unrelated issues along with their weight problems, or if the treatment itself caused this population to feel more depressed and thus decrease self-esteem (e.g., depressed over having to enter treatment because of their weight). As expected, all these results fluctuated due to gender and cultural factors. Caucasian females were more seriously affected, but males and African American and Hispanic children reported less depression or fewer problems with self-esteem because of their weight (Wardle & Cooke, 2005).

Obesity and Quality of Life

Obesity is seen to affect a person's quality of life dramatically and negatively. Quality of life has been defined as not just an absence of disease, but also as the presence of physical, mental, and social well being (Testa & Simonson, 1996). Changes in quality of life are seen in various measurable areas such as vitality, bodily pain, social functioning, role functioning, emotional functioning, and mental health (Ross et al., 2009). Obesity can negatively affect every area of life quality from physical functioning, pain, and especially psychological status.

Health-Related Quality of Life (HRQOL) is a measurement of how a person's health affects his or her overall physical and mental functioning. Measurements specifically target limitations in social, occupational, and physical functioning and may be tailored to assess quality of life in patients experiencing different physical conditions. Many instruments have been developed to measure this concept; some of the most reliable instruments are the Short Form-36 (SF-36) (Ware, Snow, Kosinski, & Gandek, 1993) and the Impact of Weight on Quality of Life (IWQoL). The SF-36 was designed to measure general health related quality of life and the IWQoL measures more specific weight related quality of life issues including weight's impact on physical functioning, self-esteem, sexual life, public distress, and work (Kolotkin, Crosby, Kosloski, & Williams, 2001; Wadden & Phelan, 2002). The Impact of Weight on Quality of Life - Lite (IWQOL-Lite) was later developed as a brief assessment of quality of life in the obese population and has been demonstrated to be a valid and reliable measure with this population (Kolotkin & Crosby, 2002).

Obesity has been shown to have a negative affect on obese individuals' health-related quality of life, as well as having negative effects on their social interactions and job satisfaction. Individuals with a high BMI were more likely to have poor physical functioning including disruption in basic life activities such as walking, bending, kneeling, and stooping (Han, Tijhuis, Lean, & Seidell, 1998). Research done with obese children has shown health related quality of life scores similar to those of children with cancer (Schwimmer, Burwinkle, & Varni, 2003). Obese children have also faced increased levels of teasing, discrimination, stigma, and have been characterized more negatively than average-weight peers (Cramer & Steinwert, 1998). These early negative interactions can lead to later negative self-evaluations and lower perceived quality of life in social and vocational areas. Early levels of stigmatization and discrimination may carry

over into later assessment of body image and self-efficacy. When measuring adults' quality of life, one can see the same negative evaluations of bodily pain, general health perception, and vitality in adults seeking treatment for obesity (Fontaine, Bartlett, & Barofsky, 1998).

Although many factors may come into play when assessing quality of life in the adult obese population (e.g., socioeconomic status [SES] and general health), there is an overall improvement in reported HRQOL symptoms as weight decreases (Nickel, Loew, & Bachler, 2007). Along with the positive effects in quality of life, Nickel et al. also saw a reduction in depression and anxiety with weight loss. It is important to note that although there is a significant overlap in measures of anxiety, depression, and quality of life, the measures used in this study (Hospital Anxiety and Depression Scale [HADS-D] and the SF-36) were shown to be acceptable instruments when examining anxiety, depression, and quality of life (Fossa & Dahl, 2002).

Vocational and Financial Implications of Obesity

Vocational success is an important component of quality of life. Overweight workers were 12 times more likely than normal weight workers to report discrimination in the work force and severely obese employees were more than 100 times more likely to report discrimination (Roehling, Roehling, & Pichler, 2007). The obese population faces overall lower rates of employment than the general population. Whether or not this is due to health complications (which may interfere with productivity in the workforce) or is due to job hiring discrimination, the result is that obesity will negatively impact a person's ability to make a living (Morris, 2007). This perceived discrimination often leads to attempts to conceal weight through dress or in avoiding work functions, and in lower levels of self-confidence than that which is seen in non-obese subjects (Puhl & Heuer, 2009). Bias in the work force can be costly for the individual, to

the company, and to society at large because of decreased productivity, increased medical expenses paid by company sponsored health plans, and increased use of sick time, including paid and unpaid days off for recovery (Rothblum, Brand, Miller, & Oetjen, 1990).

The financial costs of obesity are astounding and continue to grow yearly. Current estimates are difficult to tabulate due to the overlap of obesity with other diseases including chronic diseases such as type 2 diabetes, cardiovascular disease, several types of cancer, musculoskeletal disorders, sleep apnea, and gallbladder disease (Finkelstein, Fiebelkorn, & Wang, 2003). Tsai, Williamson, and Glick (2010) estimated that individuals with a BMI ≥ 30 kg/m^2 pay approximately $1723 more annually in additional medical expenses; Finkelstein, Trogdon, Cohen, and Dietz (2009) currently estimate that obese patients cost the healthcare system 42% more in healthcare costs, with Medicare, Medicaid, and private insurers picking up the greater cost of the bill.

Unfortunately, the cost of obesity does not end with healthcare. Social costs include absence from work and reduced productivity in corporations, unemployment (which reduces tax revenue and increases government expenditure), and even extraneous business expenses such as the costs of larger seats in theaters and fuel for aircraft. These costs are more difficult to measure but can have major deleterious effects on society (McCormick, 2007).

Etiology of Obesity

Biological

Extensive research into the genetic contribution to obesity has been conducted over the years. Twin studies conducted by Sorensen, Price, Stunkard, and Schulsinger (1989) demonstrated that environment alone was not a strong predictor of weight and that genetics had a strong influence on who would become obese. Unfortunately, the mechanisms of fuel

homeostasis are not well understood (Marti, Moreno-Aliaga, Hebebrand, & Martinez, 2004). It is generally believed that the regulation of weight is controlled by three interrelated components. These components are food intake, nutrient turnover and thermogenesis, and body fat stores. Researchers believe that the balance of these three interrelated, yet self-controlled components lead to changes in weight (Martinez, 2000).

When consuming foods, the body releases chemicals which control the appetite and satiety hormones. This process allows the person to adjust quantitative as well as qualitative nutrient intake. Heavily influenced by genetic research, scientists now believe that human food intake is not as voluntary as once thought and may instead be primarily driven by genetics (Barsh, Farooqi, & O'Rahilly, 2000). The second process of nutrient turnover and thermogenesis affects the way foods are broken down and turned into energy. When the intake of any meal is not balanced between fats, proteins, and carbohydrates, this process may slow down, causing more food to be deposited as fat instead of burned as fuel (Johnston, Day, & Swan, 2002). When a person stores food instead of burning it, that person will experience an increase in weight and consequently an increase in hunger (Martinez, 2000).

Finally, the body's natural maintenance of body fat stores signals the brain on how many of the calories taken in should be stored. Genetically, human beings are programmed for survival. This means that the body will signal the brain when it senses that a person is going below a certain amount of energy (fat) storage (Speakman, 2007). Obesity itself may alter the way the body responds to internal satiety and hunger signals. When the body's homeostatic "set point" is thrown off by obesity, this system may trigger the body to believe that it needs more fat than it actually needs, leading to an increase in body fat storage and increased weight (Barsh, Farooqi, & O'Rahilly, 2000; Martinez, 2000).

Although current studies estimate the genetic heritability of obesity to be between 45-75%, that is only part of the picture (Farooqi & O'Rahilly, 2007). Genetic variants that were previously silent may now be triggered by the availability of high-energy high-fat foods, coupled with a sedentary lifestyle (Martinez, 2000). These environmental influences may interact with genetic vulnerabilities to alter a person's weight. Unfortunately, it is difficult to separate the genetic from the environmental influence and pinpoint how each will affect the other (Marti, Moreno-Aliaga, Hebebrand, & Martinez, 2004). Human genetics protects a person from nutritional deficiencies in energy-poor environments. It is hypothesized that the modern "obesogenic" environment has overwhelmed the body's ability to balance energy expenditure, which leads to an over abundance of calories and an increase in obesity (Bellisari, 2008).

Environmental

The probability is low that the human gene pool has changed so dramatically in the last century that this change accounts for a significant increase in obesity. Scientists are looking at other factors that may have led to such a dramatic change in the human body (Poston & Foreyt, 1999). The "obesogenic environment" was a term coined to describe environments that encourage high calorie and high fat food consumption and discourage physical activity (Swinburn, Egger, & Raza, 1999). These areas essentially encourage obesity by changing the energy balance of the inhabitants of these environments (Reidpath, Burns, Garrard, Mahoney, & Townsend, 2002). There is a growing concern over the rates of obesity in industrialized countries and specifically in low SES areas. The prevalence of obesity in these areas has been traced to stress and psychological effects, culture, and the availability of high calorie, low-nutrient fast foods. The relationship between low SES and obesity appears to transcend

racial/ethnic and cultural differences. These effects appear early and last through the low SES individual's lifetime (Everson, Maty, Lynch, & Kaplan, 2002).

Some believe that this relationship between SES and obesity may be related to the availability of high fat, low nutritive, inexpensive fast foods. Analysis of the lowest SES environments reveals that this population is exposed to 2.5 times more fast food restaurants than those living in the richest areas (Reidpath et al., 2002). The increase in fast food consumption has been linked to an increase in overall calories consumed. One study by Dumanovsky, Nonas, Huang, Silver, and Bassett (2009) examined the average caloric content of food purchased during lunch in many popular fast food chains in New York. Their results showed that the average fast food meal was around 827 calories and that one in three customers purchased meals >1000 calories. These high calorie lunches greatly exceeded the 750-calorie fast food meal recommended by the restaurant industry's "healthy dining finder" (National Restaurant Association, 2010).

Behavioral

Behavioral contributions to obesity tend to be clearer for researchers looking for a cure to the obesity epidemic. Living in an obesogenic environment contributes to the lack of or discouragement of physical activity, to ease of obtaining energy dense and processed foods that are high in fat and salt, and to the development of poor eating behaviors.

Passive behaviors such as television watching and video game playing have steadily increased (Robinson, 1998). These sedentary activities have been linked with a decrease in energy output and an increase in weight. Children viewing increased amounts of television are also bombarded with more ads for calorie dense foods and sugary snacks. This advertising can influence their food choices, leading to an increased consumption of high calorie foods and

weight gain. It has been shown that children will increase their intake of calorie dense snacks and decrease their intake of healthy snacks during periods of inactivity (Rennie, Johnson, & Jebb, 2005).

Treatment of Obesity

Calorie Restriction/Dieting

The American Dietetic Association (ADA) recommends a balance of calories, proper nutrition, and exercise as a way to lose weight and maintain health (American Dietetic Association, 2010). The ADA weight loss data suggests a 500-1000 calorie a day deficit in order to safely lose ~ 1 lb a week. This balance of "calories in" versus "calories out" is often difficult to achieve in today's fast paced environment, but has been shown to be effective for people able to follow this lifestyle intervention.

Americans spend over 33 billion dollars a year on dieting programs and products. Most programs rely on a system of energy imbalance resulting in a deficit of calories leading to weight reduction. These weight loss strategies may rely on decreasing the intake of specific nutrients (e.g., fat or carbohydrate), increasing exercise, eating low-calorie meal replacements, taking diet pills (either to increase satiety or decrease hunger), or fasting (Kruger, Galuska, Serdula, & Jones, 2004). These weight reduction programs have found an average result of 8%-10% weight reduction in 16-26 weeks of treatment when following a standard lifestyle modification program.

Exercise Programs

Exercise programs for weight loss have become increasingly popular. In the year 2000, it was estimated that 32.8 million Americans spent 11.6 billion dollars on gym memberships (Dellavigna & Malmendier, 2006). Using exercise as a means for weight loss has shown limited results, as compared with many weight loss programs choosing to focus primarily on calories

consumed instead of calories burned (Donnelly & Smith, 2005). Although exercise programs have been shown to have a positive effect on food choice and eating behaviors of the dieter (Elder & Roberts, 2007), it is generally recommended that controlling calorie consumption is a better way to manage or lose weight. This increase in healthy food choices may be an additional benefit to recommending a healthy active lifestyle to the average weight loss patient. Exercise does present the dieter with some additional benefits beyond weight reduction. It can often decrease insulin resistance and improve cardiovascular health. Unfortunately, its overall role in weight reduction is limited (Ross et al., 2000).

Behavioral Treatment of Obesity

Behavior therapy is a treatment based on the principles of classical and operant conditioning. According to this theory, eating behavior is prompted by antecedent events that become strongly linked over time. In this treatment, patients are taught how to identify those cues and learn new responses (Foster, 2006) while operant conditioning rewards health-promoting behaviors and extinguishes health-inhibiting behaviors. Behavior therapy is goal-directed, process oriented, advocating small rather than large changes (Foster, Makris, & Bailer, 2005). Behavioral treatment for obesity involves multiple components such as keeping a food diary, activity records, slower eating, nutritional education, and identification of eating cues. Behavior therapy can also increase positive behaviors through reward, causing the patient not only to eliminate some of the negative behaviors, but also slowly to adopt more positive responses (Foster, 2006).

Behavior therapy is sometimes coupled with cognitive skills such as problem solving and cognitive restructuring (Foster, Makris, & Bailer, 2005). The underlying theory in cognitive therapy is that thoughts directly affect feelings and behaviors. Teaching problem solving and

cognitive restructuring skills to patients may help prevent relapse when they are unable to meet certain weight loss goals or begin having difficulty following their healthy eating plan. These cognitive techniques can help patients set realistic goals for weight and behavior change, correct negative thoughts that may occur during the dieting process, and evaluate their own success in modifying their eating and exercise habits (Foster, 2006).

Cognitive behavior therapy and behavior therapy can provide many helpful techniques to the patient attempting to lose weight (Fabricatore, 2007). Behavior therapy provides techniques such as self-monitoring, goal setting, and stimulus control. These techniques help the patient modify his or her food environment in order to decrease access to additional calories. Cognitive behavior therapy techniques such as problem-solving and cognitive restructuring can be helpful in altering a patient's negative thoughts about food and identify events that may lead to overeating (Fabricatore).

Lifestyle Modification

When cognitive and behavioral interventions are packaged together with exercise and diet recommendations, these treatments typically result in weight losses of around 5-10% of initial weight, which has been shown to produce significant improvements in obesity related illness such as problems with blood pressure and cholesterol (Blackburn, 1995). This "Lifestyle Modification" approach has been used to treat both overweight individuals and obese individuals (Wadden, Butryn, & Byrne, 2004), as well as type 2 diabetes (Delahanty & Nathan, 2008).

Bariatric Surgery

In cases of severe obesity, a surgical option may be necessary to reduce weight. Two main procedures used in this population are adjustable laparoscopic gastric banding surgery and Roux-en-Y gastric bypass surgery. In each procedure, caloric intake is reduced by decreasing

the volume of food that can be consumed at any given time. Both of these procedures induce large weight losses and may help to alleviate medical co-morbidities and reduce mortality in the patient (Blackburn, Hu, & Hutter, 2009; Garb, Welch, Zagaris, Kuhn, & Romanelli, 2009). Patients are eligible for this surgery if they have a BMI of at least 40 kg/m^2, or a BMI of 35 to 39.9 kg/m^2 and also exhibit obesity-related medical co-morbidities such as type 2 diabetes, sleep apnea, respiratory problems, osteoarthritis, gallbladder disease, or hypertension (Hope, Kumanyika, Whitt, & Shults, 2005). Although each procedure presents its own set of risks such as surgical complications and pain, the long-term effect of bariatric surgery reduces mortality in extremely obese patients and may improve overall quality of life (Nickel et al., 2007).

Diabetes

The World Health Organization (WHO) defines diabetes as "a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both" (World Health Organization, 1999). This hyperglycemia, or abnormally high concentration of glucose in the blood, is a significant risk factor of microvascular and macrovascular disease.

A key component to diabetes is the deficiency of, or inability to use insulin in the body. This insulin insensitivity disrupts the absorption of glucose in the muscles, leading to a build up of glucose in the blood. After glucose begins to build in the blood, the result is the destruction of certain microvascular systems, which can lead to both short and long term damage to the body (American Dietetic Association, 2010).

Some of the physical effects of diabetes on the body are ketoacidosis (buildup of ketone bodies typically used for energy, which can be fatal in extreme cases), ischemic heart disease (reduced blood supply to the heart muscle), stroke, retinopathy (damage to the retina leading to

possible blindness), peripheral vascular disease (obstruction of the large arteries in the legs and arms), renal failure (kidney failure or breakdown), neuropathy (damage to the nerves of the peripheral nervous system), charcot joints (progressive deterioration of a weight bearing joint), and autonomic dysfunction (American Dietetic Association, 2010).

Most common symptoms of diabetes are polydipsia (thirst), blurred vision, weight loss, and polyuria (passage of large volumes of urine). Many diabetic patients will not experience the symptoms of their disease for years and may experience organ dysfunction before being diagnosed with diabetes by a physician (American Dietetic Association, 2010).

Prevalence of Type 2 Diabetes

Type 2 diabetes is the most common form of diabetes. Although specific causes of type 2 diabetes are unknown, risk of developing type 2 diabetes will increase with increased age, weight, and with decreased physical activity. It is estimated that 23.6 million Americans (7.8% of the U.S. population) have diabetes. An additional 5.7 million people are believed to have diabetes but are undiagnosed and unaware. In the U.S., diabetes currently affects 14.9 million (9.8%) non-Hispanic whites aged 20 years or older and 3.7 million (14.7%) non-Hispanic blacks aged 20 years or older. Type 2 diabetes affects 186,300 people aged 20 and younger, representing 0.2% of all people in this age group (Centers for Disease Control and Prevention, 2008). Worldwide estimates predict that diabetes prevalence will continue to grow and even double between 2000 and 2030. This doubling of diabetes rates is due to industrialization of developing countries and to more people surviving into old age (> 65). The largest increase in diabetes is expected to occur in India and China where both industrialization and life expectancy are increasing dramatically (Wild, Roglic, Green, Sicree, & King, 2004).

Mortality Rates

Despite the tendency for diabetes to be underreported as a cause of death, it was listed as the seventh leading cause of death on all U.S. death certificates in 2006. It is reported that the risk of death is twice as high for people with diabetes as it is for people without diabetes of similar age (American Dietetic Association, 2010).

Physical Effects of Diabetes

Diabetes may result in many health problems including heart disease, high blood pressure, blindness, kidney disease, nervous system damage, and dental disease. Heart disease was listed on approximately 68% of diabetes related death certificates among people 65 years or older in 2004. Strokes were noted on 16% of diabetes related death certificates and heart disease and stroke death rates were about 2 to 4 times higher in diabetics than that of adults without diabetes (National Institute of Health, 2007). In 2003-2004, 75% of self reported diabetics had high blood pressure or were using prescription medications for hypertension. Diabetes is reported to be the leading cause of new cases of blindness among adults age 20-74; diabetic retinopathy causes 12,000 to 24,000 new cases of blindness each year. Diabetes is the leading cause of kidney failure in the U.S., accounting for 44% of all new cases (National Institutes of Health, 2007).

About 60% to 70% of people with diabetes have mild to severe forms of nervous system damage. This may include impaired sensation in feet or hands, slowed digestion of food in the stomach, carpal tunnel syndrome, erectile dysfunction, or other nerve problems. Severe nerve disease is a major contributing factor to lower extremity amputations, with more than 60% of all nontraumatic lower-limb amputations occurring in people with diabetes. People with type 2 diabetes are twice as likely as those without diabetes to suffer from periodontal gum disease.

People with poorly controlled diabetes were more than three times more likely to suffer from severe periodontitis than those without diabetes because of the decrease in circulation and the body's impaired ability to heal (National Institutes of Health, 2007).

Costs of Diabetes

It is estimated that patients with diabetes spent 2.3 times more in direct medical costs than individuals without diabetes. Total direct and indirect costs of diabetes care in the U.S. was said to total 174 billion dollars (Centers for Disease Control and Prevention, 2008). Dissecting the direct cost of diabetes treatment from obesity and other co-morbid disorders has proven difficult for researchers. Actual medical treatment of diabetes, through the development of oral medications and technical advances, has become cheaper and has led to more accurate glucose monitoring. However, patients are developing diabetes at a younger age, putting them at risk for the development of more co-morbid disorders later in life. This early development of diabetes, coupled with the increased risk of co-morbid disease has put a strain on the healthcare system. Although these are not easily identified in treatment cost surveys, diabetes itself has proven to be a costly disease both for the patient and for society at large (Roehrig, Miller, Lake, & Bryant, 2009).

Treatment of Type 2 Diabetes

Type 2 diabetes treatment is a complex process of balancing glucose and insulin. Many patients with type 2 diabetes can successfully balance their symptoms with proper diet and exercise. This may be a glucose-controlled diet relying on limiting carbohydrates and sugars to reduce the body's need for insulin, or just counting carbohydrates and monitoring blood sugar in order to keep sugars from exceeding a healthy level.

Many patients with type 2 diabetes require oral medications to control their glucose and insulin. These medications may act to increase insulin sensitivity, or increase insulin production. More severe cases of type 2 diabetes may require the direct injection of insulin. This most often occurs when the patient's pancreas ceases to produce insulin or the body is unable to detect the insulin being produced.

Relationship between Diabetes and Obesity

There is a strong relationship between type 2 diabetes and obesity. Zimmet, Alberti, and Shaw (2001) coined the phrase "diabesity", relating to the interdependence of each diagnosis and examined the progression from obesity to diabetes in people who have a genetic predisposition to diabetes and became obese, as well as those who have the same history but did not become obese. The results of this study showed glucose impairment in both populations, but a much higher rate of type 2 diabetes in the group that later became obese. The reverse effect was also seen when previously obese subjects were able to lose ~10kg of weight resulting in better insulin secretion and less insulin resistance.

The development from being overweight to developing type 2 diabetes appears to be a stepwise process. It begins with a progressive defect in insulin secretion, with the slow development of insulin resistance. As body fat increases, the body begins to resist insulin. The pancreas responds by secreting more insulin into the bloodstream to produce normoglycaemia. Over time, the body's ability to produce insulin decreases and the result is the development of type 2 diabetes (Golay & Ybarra, 2005).

Unfortunately, the number of people becoming obese continues to climb. The largest growing group are people with class III obesity (people with a BMI >40). This rise in weight occurs in both the type 2 diabetic population as well as in people without diabetes. Men

diagnosed with both type 2 diabetes and obesity are 40% more likely to have a cardiovascular problem and women diagnosed with type 2 diabetes have increased their risk by 300% (Kramer et al. 2009). As the result, this combination of diabetes and obesity greatly increases mortality.

Weight Loss Programs and Diabetes

Because of the strong relationship between weight and type 2 diabetes, many programs have attempted to gear their treatment towards diabetes prevention and treatment by reducing weight and macronutrient contributions to the development of the disease (Klein et al., 2004). Dieting programs have explored the relationship between type 2 diabetes and fat consumption (Riserus, Willett, & Hu, 2009) as well as carbohydrate amount and type (Sheard et al., 2004). Many studies have examined the relationship between dietary fats, proteins, and carbohydrates and their benefits in weight reduction as well as their effect on insulin secretion in obese and overweight subjects (McAuley et al., 2005; Samaha et al., 2003; Yancy, Olsen, Guyton, Bakst, & Westman, 2004). Each study found a benefit in weight reduction in each diet but final analysis showed that no diet was superior to another in reducing weight in this population (Sacks et al., 2009).

More recently, focus was directed to using the glycemic index (GI) as a way both to reduce weight and to control diabetes in patients with type 2 diabetes (Ma et al., 2008). The GI is a way to measure the effect that food has on glucose levels in the bloodstream. Blood glucose can lead to an increase or decrease in hunger (Wolever, Jenkins, Jenkins, & Josse, 1991). Studies found a favorable amount of weight loss with these glycemic load controlled diets. Glycemic controlled diets have also demonstrated that a dietary intervention can be as useful as pharmacological agents in controlling postprandial hyperglycemia in some patients (Brand-Miller, Hayne, Petocz, & Colagiuri, 2003) and can help to reduce weight in overweight adults

with high insulin secretion (Pittas et al., 2005). These glycemic-controlled diets have also shown cardiovascular risk reduction in this population (McMillan-Price et al., 2006). This means that many patients may be able to control their diabetes using a glycemic load controlled diet without the use of medication.

Attrition in Weight Loss Programs

Unfortunately, many lifestyle intervention programs are plagued with high rates of attrition. Attrition from weight loss programs is estimated to be as high as 34-46% in hospital-based and pharmacological interventions (Fabricatore et al., 2009; Wadden, Foster, Letizia, & Stunkard, 1992) and 25-70% in commercial weight reduction programs (Heshka et al., 2003; Volkmar, Stunkard, Woolston, & Bailey, 1981). Factors correlated with attrition rates have been extensively studied but results have varied.

In many studies, age appears to correlate consistently with increased attrition, with younger participants dropping out of studies more often than older participants (Dalle Grave et al., 2005). One study conducted by Honas, Early, Frederickson, and O'Brian (2003) showed an increase in attrition rates in subjects who were not only younger (< 40 years old) but also divorced, were female, and were African American. It has been theorized that patients in this group may have less time to dedicate towards weight loss; past research has shown that patients working full time or who have fewer hours to spend on weight loss will drop out at an increased rate (Gucciardi, Demelo, Offenheim, & Stewart, 2008; Huisman, Maes, Degucht, Chatrou, & Haak, 2009; Inelmen et al., 2005; Kolotkin & Moore, 1983). Many patients cite practical reasons, such as work and family obligations, for their dropping out (Grossi et al., 2006). Younger patients may also not experience the negative health impact of their weight, or believe that they are immune to future complications.

Psychological variables were also explored in the research, from weight loss studies, to examine the effect of these variables on attrition although this data are less clear. These studies showed an increase in attrition among patients reporting a high level of depressive symptoms at baseline (Fabricatore et al., 2009), or among patients having had a past history of depression (Clark, Niaura, King, & Pera, 1996). Other researchers saw an increase in attrition if the subject had a history of emotional or physical health difficulties (Yass-Reed, Barry, & Dacey, 1993).

Conflicting research has shown an increase in attrition rates in participants with lower levels of depression and a decrease in attrition in those participants reporting high rates of depression as well. This may be due to the lower rates of obesity- related diseases in this subgroup, or possibly that the presence of mood disorders may actually work to reinforce the need for weight reduction and therefore decrease attrition rates in this population (Inelmen et al., 2005). From these studies, it is possible to see the powerful impact that psychological health can have on attrition from weight loss programs. Even if patients are not currently experiencing symptoms, their histories of emotional instability may affect not only their current treatment, but also how they view their own progress in the program.

Identifying the underlying causes of attrition has been difficult for researchers. Many of the factors around increased attrition appear to be related to issues of self-efficacy and motivation. Increased self-efficacy appears to decrease attrition rates in weight loss programs (Bernier & Avard, 1986), helping subjects to feel greater success in their weight loss even when results were less than what they expected (Mitchell & Stuart, 1984). Much of this effect appears to be attributed to patients focusing more definitely on the "task" of weight control, instead of the "end goal" of weight control. Focusing on the "task" of weight control (e.g., measuring

caloric values, meal planning, and journaling) helped patients stay with a weight loss lifestyle intervention longer.

Low weight loss in the early stages of weight loss programs is often associated with attrition (Teixeira et al., 2002). Patients often enter weight reduction programs expecting to lose a greater-than-average amount of weight. When they fail to lose large amounts of weight early in the treatment (or, in fact, gain weight), they become discouraged and are more likely to drop out of the program (Fabricatore, 2007; Gucciardi, Demelo, Offenheim, & Stewart, 2008). Unrealistic expectation of weight loss is an issue that plagues all weight reduction programs. Although moderate reductions in weight can significantly decrease mortality in obese patients (Blackburn, 1995), most obese patients see the average reduction as highly unsatisfactory. Clients may report expected weight loss of twice the average reduction. Foster, Wadden, Vogt, and Brewer (1997) found that the average dieter wished to lose about a third of their starting weight, which was three times more than the typical weight loss with the information being offered. Clients report dissatisfaction when treatment providers review the average expected weight loss numbers and will often declare that they will exceed the average result (Wadden et al., 2003). These unrealistic goals for weight loss lead to feelings of failure and dissatisfaction when patients are unable to reach these goals (Teixeira et al., 2004). Unrealistic expectations for weight loss have been linked to increased attrition rates in some studies (Dalle Grave et al., 2005), but not others (Fabricatore et al., 2007). Unfortunately, as BMI increased, so did expected weight loss. As the patient's anticipated weight loss rose over the average 10% reduction, so did risk of attrition (Dalle Grave et al., 2004).

The relationship between weight and self-esteem is complicated. Many studies have explored the negative effect of weight on self-esteem, but determining how self-esteem affects

weight loss and dieting behavior is more complex. A meta-analysis conducted by Miller and Downey (1999) showed a significant relationship between weight and self-esteem. Examining 71 different studies, they concluded that although there was a significant relationship between self-esteem and weight, it was difficult to determine the exact nature of that relationship. They hypothesized that low self-esteem could be the result of being overweight, but also that low self-esteem could contribute to weight gain. This effect is especially true for binge eaters who may use food as a way to escape self-awareness, which they find painful. The authors also speculated that efforts to control weight such as dieting and exercise could negatively affect self-esteem because of the perception that others will judge them for not being able to lose weight and that they lack willpower and self-discipline.

Success in Weight Loss Programs

Success in behavioral weight loss treatment with obese patients is usually measured by a reduction of around 5-10% of initial bodyweight. Studies have found consistent predictors of success to be fewer previous dieting attempts (Martin, O'Neil, & Binks, 2002; Teixeira et al., 2004), increased self-motivation, general feeling of self-efficacy, attendance at treatment sessions (Wadden et al., 2009), and dieting autonomy (Williams, Grow, Freedman, Ryan, & Deci, 1996). There appear to be a greater number of mixed results when examining the relationships between success and initial body weight/baseline BMI, body image, body size satisfaction (Teixeira et al., 2002), eating self-efficacy, realistic weight loss goals/expectations, and internal locus of control. Only minor supportive evidence toward weight loss success has been seen when measuring factors such as exercise, self-efficacy, perceived barriers towards weight loss, obesity specific quality of life, perceived autonomy, and social support (Teixeira, Going, Sardinha, & Lohman, 2005).

In an obese population, increased weight loss early in the program has been found to be a predictor of success in weight reduction programs. Wadden et al. (1992) found that patients who lost the greatest amount of weight during the first month of treatment lost the greatest amount of weight at the end of treatment. However, Jeffery, Wing, and Mayer (1998) found that it was not the amount of weight lost, but the reaching of an early achievable goal (as identified by the participant) that resulted in greater weight reduction at the end of treatment. Other studies have found that when the patient feels unsatisfied with the degree of early weight loss, the result is higher attrition and poorer outcome (Carels, Cacciapaglia, Douglass, Rydin, & O'Brian, 2003).

Although setting and achieving early weight loss goals is important, studies have found that having a realistic goal in weight loss is important both for weight loss success and for reducing attrition from weight loss programs (Carels et al., 2003; Jeffery et al., 1998). Realistic expectations set by most obesity programs inform patients that they can expect a 5-15% weight reduction. Unfortunately, most patients set unrealistic goals expecting to lose 25% or more of their weight during the first year of treatment (Foster, Wadden, Vogt, & Brewer, 1997; Wadden et al., 2003). Patients with unrealistic goals for weight loss may become discouraged by their average (or below average) weight losses during the treatment. This may result in the patient becoming disillusioned, a higher rate of attrition, decreased motivation, and lower weight reduction at the end of treatment (Teixeira et al., 2002). This decrease in self-efficacy may also increase the rate of relapse after treatment (Foster et al.).

Evidence of how self-esteem may affect weight loss success and attrition is scarce and has resulted in mixed findings (Teixeira et al., 2005). Evidence has been noted linking positive self-esteem with decreases in weight in the short term, but not in the long term. Increased self-esteem has been found to increase the duration of weight reduction maintenance (Nir &

Neumann, 1995). People who are assured that they will lose more weight will be more likely to meet their weight loss goals (Dennis & Goldberg, 1996).

Quality of life at baseline has been used to predict weight loss and attrition in a limited number of studies (Teixeira et al., 2005). Overall results analyzing the effect of quality of life on treatment outcome has shown that lower quality of life scores at baseline typically result in a greater rate of treatment completion, but these clients are more likely to finish treatment with less weight loss (Teixeira et al., 2002). Another study by Carels et al. (2003) showed an increased attrition rate in patients whose HRQOL scores did not improve by the 4^{th} week of treatment.

Overall, it can be seen how weight loss motivation and self-efficacy are related to patients' expected weight loss, to early treatment weight loss, to self-esteem, and to weight related quality of life. These factors play an important role in obese individuals' ability to make and maintain the behavioral changes prescribed in lifestyle modification interventions designed to help these individuals lose weight or control diabetes. Unfortunately, much of the weight loss research does not look at attrition rates and success rates between obese patients with diabetes and obese patients without diabetes. At this time, it appears that the current study will be the first of its kind to examine factors related to attrition and to success in a weight reduction program, specifically for patients diagnosed with type 2 diabetes.

Chapter Three: Hypotheses

Overall Question

The current study is guided by the following question: What factors predict weight loss success or predict attrition among people with type 2 diabetes who participate in a lifestyle modification program? This question will be examined by analyzing baseline and outcome data from a randomized controlled trial that compared weight loss and diabetes control among obese patients with type 2 diabetes who were randomized to receive either a low-fat or low-glycemic load diet as part of a lifestyle modification program. Because each group in the original study was required to fulfill the same lifestyle modification program (e.g., same caloric content, weekly groups, etc.) the two study groups will be combined into one single group for this study.

Hypothesis 1

Ho: Early weight loss (5^{th} week) will not significantly predict successful weight loss or attrition.

H_1: Early weight loss (5^{th} week) will significantly predict successful weight loss and attrition at 40 weeks, i.e., subjects who lost the greatest amount of weight at week 5 are expected show a lower rate of attrition and show a weight reduction of $\geq$5% at week 40.

Rationale: Subjects who show early success in their weight loss will be more motivated to continue with the program, which will lead to greater weight loss at 40 weeks.

Hypothesis 2

Ho: Unrealistic expectations of weight loss at the beginning of the diet will not significantly predict attrition or weight loss success at 40 weeks.

H_1: Ambitious expectations for weight loss (greater than 20% of starting weight) will negatively predict weight loss and will predict attrition in both groups, i.e., subjects who hope to achieve a reduction of over 20% of their starting weight will display a higher risk of attrition and lower rate of success.

Rationale: Subjects who believe their efforts are not leading to desirable results are more likely to reduce or discontinue those efforts, leading to attrition and lower weight loss.

Hypothesis 3

Ho: Baseline self-esteem will have no significant effect on risk of attrition or of success.

H_1: Baseline self-esteem will predict weight loss and attrition, i.e., subjects who report higher levels of self-esteem will be more likely to achieve weight loss success, as measured by a ≥5% weight reduction and will be less likely to drop out of the study.

Rationale: Subjects who report higher self-esteem will be more likely to follow through with a regimented program for weight reduction. These subjects will be less likely to drop out of the program if they deviate from their eating schedule or do not lose expected weight during any part of the trial.

Hypothesis 4

Ho: Baseline quality of life will not predict attrition or success.

H_1: Subjects with lower baseline quality of life will lose more weight and show lower risk of attrition.

Rationale: Subjects who have lower quality of life scores will be more motivated to lose weight and stay on a structured program because of the difficulties they are facing from their obesity.

Thus, subjects who report lower quality of life will show less risk of attrition and be more likely to lose ≥5% of baseline weight at 40 weeks.

Chapter Four: Methods

Overview

This chapter describes the methodology of the current study, including its design, participants, procedures, and potential benefit to others.

Design and Design Justification

The current study will utilize an archival-data design. The data were originally collected as part of a randomized clinical trial conducted at the University of Pennsylvania Center for Weight and Eating Disorders (Fabricatore et al., 2011). This study examined the differences in weight loss and glycemic control among overweight and obese individuals diagnosed with type 2 diabetes who participated in a lifestyle modification program. The subjects were randomly assigned to receive a conventional Low-Fat (LF) diet or an alternative Low-Glycemic Load (LG) diet. The trial included 40 weeks of treatment and an additional 52 weeks of follow-up. Only data from baseline and the end of treatment (i.e., weeks 0 and 40, respectively) are used in the current analysis.

Inclusion/Exclusion Criteria

The subjects who were eligible to participate in the original trial must have had a diagnosis of type 2 diabetes, verified by a treating physician. Subjects must have a BMI of 27 - 45 kg/m^2 with weight $\leq$ 136 kg (300 lbs.), capacity to provide written informed consent, willingness and commitment to return for all clinic visits, complete all study-related procedures, and live within a 30 mile radius of the clinic. Subjects also must have a systolic blood pressure between 90 and 160 mm Hg, inclusive and a diastolic blood pressure between 65 and 100 mm Hg, inclusive, as well as a resting heart rate between 65 and 90 beats per minute, inclusive.

Subjects were excluded from the study if they had a recent (i.e., within 1 year) myocardial infarction, unstable angina, malignant arrhythmias, cancer (active or in remission for fewer than 5 years), history of cerebrovascular, renal, or hepatic disease, history of seizures, protein wasting diseases (e.g., Cushing's syndrome), uncontrolled hypertension (> 160/100 mm Hg), type 1 diabetes, uncontrolled thyroid disease, pregnancy or lactation, electrolyte abnormalities, clinically significant psychosocial impairment (principally, major depression) or treatment with steroids.

Participants

The participants of this study were those subjects who enrolled at baseline and completed all baseline questionnaires. According to the study, 79 subjects (N = 79) were randomized and completed baseline assessment. All subjects were between the ages of 31 and 65 and had a BMI of at least 27 kg/m^2. Subjects completed questionnaires at pre-baseline, at baseline, at 20 weeks, and at 40 weeks of treatment. Weight was also recorded at all visits.

Screening Procedures to Determine Inclusion/Exclusion Criteria

Patients who expressed interest were contacted by a research assistant who screened patients by telephone for inclusion and exclusion criteria. Qualified patients were mailed the Weight and Lifestyle Inventory (WALI). They were scheduled for an initial visit during which time they were given the full description of the study, provided written informed consent to participate, screened for weight, BMI, blood pressure, and pulse. Consenting individuals were then given an appointment for baseline assessment, a packet of questionnaires, and a 3-day food journal to be completed prior to assessment. Participants were also given a referral to a physician who performed a physical examination and history. Physicians were informed that subjects would be enrolled in the study with the expectation that medications will be held

constant during the trial; with the exception of changes required in response to medical emergency (i.e., reductions in insulin to reduce the risk of hypoglycemia).

Recruitment

Participants were recruited from public service announcements, notices in local media, referrals from local physicians, the Pennsylvania Integrated Clinical and Administrative Research Database (PICARD), direct mailing service Aldata, and the website Craigslist.

Plan for Informed Consent Procedures

All subjects provided informed consent to participate in the randomized controlled trial. Consent to be included in the proposed analysis was not required.

Measures

The current study will analyze initial baseline data from the study conducted by Dr. Fabricatore and colleagues. The baseline measurements used were the self-esteem question listed in the WALI, reported expected weight loss listed in the WALI, IWQoL-Lite measurement at baseline, and measured weight loss at 5 weeks. The WALI is self-report questionnaire that examines biological, environmental, social, psychological, and temporal factors related to weight (Wadden & Foster, 2003). The WALI has good test retest reliability for items measuring self-esteem and self-perception (r = .69 - .97); the WALI self-esteem items correlated with the Rosenberg Self Esteem Scale (r = .62) (Wadden et al., 2006).

The Impact of Weight on Quality of Life (IWQoL) measures weight-related quality of life issues including weight's impact on physical functioning, self-esteem, sexual life, public distress, and work (Kolotkin, Crosby, Kosloski, & Williams, 2001; Wadden & Phelan, 2002). The Impact of Weight on Quality of Life - Lite (IWQOL-Lite) was later developed as a brief

assessment of quality of life in the obese population and has been demonstrated to be a valid and reliable measure with this population (Kolotkin & Crosby, 2002).

Procedure

The current study was conducted using original data from the study's principal investigator, Anthony N. Fabricatore, Ph.D. Permission was obtained to use the study's de-identified data set; the WALI data were analyzed to look for differences in baseline self-esteem as a predictor of attrition and of successful weight loss at 40 weeks. The IWQoL-Lite was examined to compare baseline differences in the attrition group and in the success group to see if quality of life affected the rate of attrition and the rate of success in the completion group at 40 weeks. Expected weight loss data (taken from the WALI) were calculated as a percentage from initial weight and were used to estimate if expected weight loss affected attrition and affected success. Finally, weight loss data at week 5 were examined as a percentage of weight and examined as a predictor for success and as a predictor for attrition in this study.

Analysis of Risk/Benefit Ratio

Potential Risk to Participants

There is no risk to the subjects of the current study due to its archival-data design.

Potential Benefit to Participants

There is no benefit to the subjects of the current study due to its archival-data design.

Potential Benefit to Others

The current study may potentially benefit others who have been diagnosed with type 2 diabetes and are trying to lose weight. Data have shown that a modest decrease in weight can have significant beneficial effects on health. Because loss of motivation and self-efficacy can significantly affect individuals' willingness to stay with a weight loss plan and be successful,

information on how to identify (and potentially address) these issues may increase the likelihood of success and decrease attrition rates in weight loss programs that enroll diabetic patients.

Procedure for Maintaining Confidentiality

The subjects' charts will remain in a locked filing cabinet at the Center for Weight and Eating Disorders at the University of Pennsylvania to ensure confidentiality of the subjects' information. Data that has been provided will be de-identified and no information will be released regarding the identities of the participants involved.

Chapter Five: Results

Statistical Analysis

Analysis of the data was conducted in order to test the listed hypotheses. Dependent variables in this study consist of attrition and success. Attrition was defined as, "Subject did not complete the first 40 weeks of the study" and divided into two categories, "dropped out before the first 40 weeks," and "did not drop out before 40 weeks." Success was measured similarly by dividing this category into two groups. Participants were classified as successful if they achieved and maintained at least a 5% reduction in initial body weight at week 40. Participants were deemed unsuccessful if their weight loss was less than 5% of their initial weight. Baseline weight values were carried forward for participants who dropped out of treatment. Thus, anyone who prematurely discontinued treatment was classified as unsuccessful, regardless of their weight loss at the time of attrition.

The first hypothesis measured how 5^{th} week weight loss affected rate of attrition and rate of success in the study. Participants were categorized into "low," "medium," and "high" tertiles of weight loss at week 5. The three-level early weight loss variables were examined in separate logistic regression analyses with attrition and success as the outcome variables. Logistic regression yielded the odds of success or attrition (depending on the outcome variable) for those in the "medium" and "high" categories of early weight loss, compared with those in the "low" category of early weight loss.

The second hypothesis examined the relationships of weight loss expectations both to success and to attrition. Weight loss expectation was divided into three categories: low weight reduction was labeled as "up to 20% reduction from baseline"; medium weight reduction was defined as "20-30% of baseline weight at 40 weeks", and high weight loss was defined as ">30%

reduction of baseline weight." These levels of expectation were again analyzed against the two dependent variables of attrition and success using a logistic regression. This analysis compared the odds of attrition and the odds of success among those in the "medium" and "high" categories of expected weight loss, compared with those in the "low" category of expected weight loss.

The third hypothesis examined the relationships of self-esteem at baseline both to attrition and to success. Self-esteem was assessed with a single item on the WALI: "In general I am…" Responses were reported on a five-point scale, in which 1= "very happy with who I am", 2 = "happy with who I am", 3 = "ok with who I am but have some mixed feelings", 4 = "unhappy with who I am", 5 = "very unhappy with who I am." Participants who scored 1 or 2 were categorized as having "positive" self-esteem, whereas those who scored 4 or 5 were classified as having "negative" self-esteem. Participants who scored 3 were classified as a separate group, defined as having "mixed" self-esteem. These three levels of self-esteem were analyzed against the dependent variables, using a logistic regression to examine how identified self-esteem may predict success and attrition at 40 weeks. Again the groups were compared, looking at the "mixed" and "negative" self-esteem groups against the "positive" self-esteem group to obtain an odds ratio of the relationship between self-esteem to success and self-esteem to attrition.

Finally, the fourth hypothesis examined how quality of life, measured by the IWQOL-Lite, relates to rate of attrition and success at 40 weeks. Full-scale data from the IWQOL-Lite were normed and divided into two groups. Subjects were placed into the "impaired quality of life" group if they scored at least one standard deviation above the scale's norm. All other subjects were considered in the "unimpaired quality of life." These two groups were analyzed

against the dependent variables, using a logistic regression to examine the predictive ability of each group to the dependent variables of success and attrition.

Results

In the early analysis, the predictor variables of early weight loss (5^{th} week), weight loss goals, quality of life, and self-esteem were correlated to determine the independence of these predictors. As shown in table 1, the correlations among the predictors indicated no overlap and each variable was analyzed against the dependent variables of attrition and success. Each variable was analyzed, using logistic regression to calculate the odds ratios of the independent variables' ability to predict the dependent variable.

Table 1

Correlation of Predictors

	Constant	Quality of Life	Self Esteem	Weight Loss Goal	5^{th} Week Weight Loss
Constant	1.000	-.839	-.527	-.426	-.222
Quality Of Life	-.839	1.000	.377	.255	-.078
Self Esteem	-.527	.377	1.000	-.013	-.073
Wt Loss Goal	-.426	.255	-.013	1.000	-.330
5^{th} Wk Wt Loss	-.222	-.078	-.073	-.330	1.000

In the first hypothesis examining early weight loss, the data were divided into 3 tertiles classified as low (lost less than 0.48% of initial body weight), medium (lost 0.49% to 2.15%) and high (lost 2.16% or more). Attrition rates in these groups were 65.4%, 29.6%, and 15.4% respectively (see table 2). The lowest tertile was used as a reference group to see if the medium and high tertile were significant predictors of retention at week 40. As compared with subjects in the low weight tertile, those in the medium and high tertiles were significantly less likely to

drop out of the study (OR = 0.096, 95% CI: 0.025, 0.367; OR = 0.223, CI: 0.070, 0.708), respectively. Said differently, the odds of dropping out of the study for those in the low tertile of early weight loss were nearly five and ten times higher than those in the medium and high groups, respectively (OR = 4.489; 95% CI: 1.413, 14.246; OR = 10.389; 95% CI: 2.728, 39.560) (see table 3).

Table 2

Crosstabulation of Early Weight Loss and Attrition

		Did Patient Complete 40 Weeks of Treatment?		
		No	**Yes**	**Total**
Weight Gained or Lowest Loss at Week 5	Count	17	9	26
	% Within Tertile	65.4%	34.6%	100.0%
Medium Tertile of Weight Loss at Week 5	Count	8	19	27
	% Within Tertile	29.6%	70.4%	100.0%
Highest Tertile of Weight Loss at Week 5	Count	4	22	26
	% Within Tertile	15.4%	84.6%	100.0%
Total	Count	29	50	79
	% Within Tertile	36.7%	63.3%	100.0%

Table 3

Early Weight Loss and Attrition Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Weight Gained or Lowest Loss at Week 5			13.236	2	.001			
Medium Tertile of Weight Loss at Week 5	1.501	.590	6.482	1	.011	4.486	1.413	14.246
Highest Tertile of Weight Loss at Week 5	2.341	.682	11.773	1	.001	10.389	2.728	39.560
Constant	-.636	.412	2.380	1	.123	.529		

In the second analysis examining overall weight loss at week 40, the same tertile breakdown was made but was analyzed against the dependent variable of losing 5% of weight or more at week 40. Success rates in these groups were 11.5%, 33.3%, and 57.7% respectively (see table 4). Again using the lowest tertile as a reference group, patients in the middle group were not significantly more likely to achieve success (i.e., to lose at least 5% of their weight) at week 40 (OR = 3.833, CI: .904, 16.259). The group that lost the greatest amount of weight at week 5 were significantly more likely to succeed in losing at least 5% of their weight at week 40 (OR = 10.455, CI: 2.495, 43.808) (see table 5).

Table 4

Crosstabulation of Early Weight Loss and Success

		Did Patient Lose 5% or Greater Weight		
		No	**Yes**	**Total**
Weight Gained or Lowest Loss at Week 5	Count	23	3	26
	% Within Tertile	88.5%	11.5%	100.0%
Medium Tertile of Weight Loss at Week 5	Count	18	9	27
	% Within Tertile	66.7%	33.3%	100.0%
Highest Tertile of Weight Loss at Week 5	Count	11	15	26
	% Within Tertile	15.4%	84.6%	100.0%
Total	Count	29	50	79
	% Within Tertile	42.3%	57.7%	100.0%

Table 5

Early Weight Loss and Success Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Weight Gained or Lowest Loss at Week 5			10.657	2	.005			
Medium Tertile of Weight Loss at Week 5	1.344	.737	3.322	1	.068	3.833	.904	16.259
Highest Tertile of Weight Loss at Week 5	2.347	.731	10.308	1	.001	10.455	2.495	43.808
Constant	-2.037	.614	11.011	1	.001	.130		

The second hypothesis addressed how weight loss goals at baseline were related to success and attrition at week 40. Participants' weight loss goals (as % of initial weight) were divided into three categories of low weight loss goal (0% to 20%), medium (>20% to 30%), and high (≥ 30%). Attrition rates in these groups were 31.6%, 31.2%, and 47.8%, respectively (see table 6). Weight loss goals were entered into logistic regression analyses with attrition and success at week 40 as the dependent variables. Using the low goal group as a reference group, there did not appear to be a significant increase in the odds of attrition in the medium group (OR = 1.015 CI: .299, 3.448) or in the high goal group (OR = .503 CI: .142, 1.787), based on the goals set at baseline. In other words, in this population setting a higher goal at baseline did not significantly increase the odds of dropping out at week 40 (see table 7).

Table 6

Crosstabulation of Weight Loss Goals and Attrition

		Did Patient Complete 40 Weeks of Treatment?		
		No	**Yes**	**Total**
Low Weight Loss Goal	Count	6	13	19
	% Within Tertile	31.6%	68.4%	100.0%
Medium Weight Loss Goal	Count	10	22	32
	% Within Tertile	31.2%	68.8%	100.0%
High Weight Loss Goal	Count	11	12	23
	% Within Tertile	47.8%	52.2%	100.0%
Total	Count	27	47	74
	% Within Tertile	36.5%	63.5%	100.0%

Table 7

Weight Loss Goals and Attrition Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Low Weight Loss Goal			1.825	2	.402			
Medium Weight Loss Goal	.015	.624	.001	1	.980	1.015	.299	3.448
High Weight Loss Goal	-.686	.646	1.127	1	.288	.503	.142	1.787
Constant	.773	.494	2.454	1	.117	2.167		

Similarly, no significant effect of weight loss goal was seen when looking at the dependent variable of success in a weight loss of 5% or greater at week 40. Success rates in these groups were 31.6%, 50.0%, and 21.7%, respectively (see table 8). Using the low weight loss goal as the reference group, the middle goal group did not show an increased odds ratio weight loss success (OR = 2.167, CI: 0.659, 7.121) nor did the highest goal group (OR = 0.602, CI: 0.151, 2.404) (see table 9).

Table 8

Crosstabulation of Weight Loss Goal and Success

		Did Patient Lose 5% or Greater Weight?		
		No	**Yes**	**Total**
Low Weight Loss Goal	Count	13	6	19
	% Within Tertile	68.4%	31.6%	100.0%
Medium Weight Loss Goal	Count	16	16	32
	% Within Tertile	50.0%	50.0%	100.0%
High Weight Loss Goal	Count	18	5	23
	% Within Tertile	78.3%	21.7%	100.0%
Total	Count	47	27	74
	% Within Tertile	63.5%	36.5%	100.0%

Table 9

Weight Loss Goal and Success Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Low Weight Loss Goal			4.691	2	.096			
Medium Weight Loss Goal	.773	.607	1.622	1	.203	2.167	.659	7.121
High Weight Loss Goal	-.508	.707	.516	1	.472	.602	.151	2.404
Constant	-.773	.494	2.454	1	.117	.462		

In the third hypothesis examining self-esteem, participants were categorized as having positive, mixed, or negative self-esteem. Only 91.1% of the baseline subjects completed the WALI item assessing self-esteem (n = 72). Attrition rates in the three self-esteem groups were 35.6%, 36.8%, and 25.0%, respectively (see table 10). The positive self-esteem category was

used as a reference group to see if the mixed and negative self-esteem groups were significant predictors of attrition at week 40. As compared with the positive self-esteem group, there did not appear to be any significant effect on odds of attrition either in the mixed self-esteem group (OR = 0.604, CI: 0.109, 3.350) or in the negative self-esteem group (OR = 0.571, CI: 0.090, 3.641) (see table 11).

Table 10

Crosstabulation of Self Esteem and Attrition

		Did Patient Complete 40 Weeks of Treatment?		
		No	**Yes**	**Total**
Positive Self Esteem	Count	16	29	45
	% Within Tertile	35.6%	64.4%	100.0%
Mixed Self Esteem	Count	7	12	19
	% Within Tertile	36.8%	63.2%	100.0%
Negative Self Esteem	Count	2	6	8
	% Within Tertile	25.0%	75.0%	100.0%
Total	Count	25	47	72
	% Within Tertile	34.7%	65.3%	100.0%

Table 11

Self Esteem and Attrition Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Positive Self Esteem			.379	2	.828			
Mixed Self Esteem	-.504	.874	.333	1	.564	.604	.109	3.350
Negative Self Esteem	-.560	.945	.351	1	.554	.571	.090	3.641
Constant	1.099	.816	1.810	1	.178	3.000		

In the second analysis for overall weight loss at week 40, the same category breakdown was made but was analyzed against the dependent variable of weight loss of 5% or more at week 40. Success rates in these groups were 37.5, 42.1%, and 35.6% respectively (see table 12). Again, using the positive self-esteem category as a reference group, no significant odds ratio was

seen in the mixed self-esteem group (OR = 0.920, CI: 0.194, 4.359), or the negative self-esteem group (OR = 1.212, CI: 0.222, 6.612) (see table 13).

Table 12

Crosstabulation of Self Esteem and Success

		Did Patient Lose 5% Weight or Greater?		
		No	**Yes**	**Total**
Positive Self Esteem	Count	5	3	8
	% Within Tertile	62.5%	37.5%	100.0%
Mixed Self Esteem	Count	11	8	19
	% Within Tertile	57.9%	42.1%	100.0%
Negative Self Esteem	Count	29	16	45
	% Within Tertile	64.4%	35.6%	100.0%
Total	Count	45	27	72
	% Within Tertile	62.5%	37.5%	100.0%

Table 13

Self Esteem and Success Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Positive Self Esteem			.244	2	.885			
Mixed Self Esteem	-.084	.794	.011	1	.916	.920	.194	4.359
Negative Self Esteem	.192	.866	.049	1	.824	1.212	.222	6.612
Constant	-.511	.730	.489	1	.484	.600		

In the fourth hypothesis examining weight related quality of life, the data were divided into two groups, unimpaired quality of life and impaired quality of life. These groups were taken from within the sample by looking at the mean score on the IWQOL-Lite and using 1 standard deviation above the mean to identify the impaired group. Attrition rates for the impaired and unimpaired groups were 33.3% and 37.7% respectively (see table 14). The unimpaired group was used as a reference group to see if the impaired group was a significant predictor of retention at week 40. As compared with the unimpaired group, the impairment did not significantly affect the attrition rate in this population (OR = 1.211 CI: 0.400, 3.667) (see table 15).

Table 14

Crosstabulation Quality of Life and Attrition

		Did Patient Complete 40 Weeks of Treatment?		
		No	**Yes**	**Total**
Impaired Quality of Life	Count	6	12	18
	% Within Tertile	33.3%	66.7%	100.0%
No Impaired Quality of Life	Count	23	38	61
	% Within Tertile	37.7%	62.3%	100.0%
Total	Count	29	50	79
	% Within Tertile	36.7%	63.3%	100.0%

Table 15

Quality of Life and Attrition Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Impaired Quality of Life	.191	.566	.114	1	.735	1.211	.400	3.667
Constant	.502	.264	3.612	1	.057	1.652		

In the second analysis for overall weight loss at week 40, the same breakdown was made but was analyzed against the dependent variable of weight loss of 5% or more at week 40. The success rates for the impaired and unimpaired groups were 33.3% and 34.4%, respectively (see table 16). Again using the unimpaired group as a reference group, quality of life impairment did not significantly predict success at week 40 (OR = 0.952, CI: 0.313, 2.899) (see table 17).

Table 16

Crosstabulation of Quality of Life and Success

		Did Patient Lose 5% Weight or Greater?		
		No	**Yes**	**Total**
Impaired Quality of Life	Count	12	6	18
	% Within Tertile	66.7%	33.3%	100.0%
No Impaired Quality of Life	Count	40	21	61
	% Within Tertile	65.6%	34.4%	100.0%
Total	Count	52	27	79
	% Within Tertile	65.8%	34.2%	100.0%

Table 17

Quality of Life and Success Regression Table

							95.0% C.I for OR	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Impaired Quality of Life	-.049	.568	.007	1	.932	.952	.313	2.899
Constant	-.644	.269	5.717	1	.017	.525		

Chapter Six: Discussion

The current archival study was designed to examine baseline and early treatment factors that were related to attrition and success in a weight reduction program with patients diagnosed with type 2 diabetes. Prior studies have shown mixed results when trying to predict weight loss program success and attrition. This study examined not only the combination of obesity and diabetes but also how this combination may present a more complicated landscape when predicting success and attrition in patients attempting to lose weight. At this time it appears that the current study is the first to examine these factors in this distinct population. Specifically, the researcher looked at quality of life, expected weight loss, self-esteem, and early weight loss in relation to attrition and success, defined as a 5% or greater reduction in initial weight.

Summary and Integration of Results

Examining early weight reductions effect on attrition and success in this population, the group that lost the greatest amount of weight at week 5 was more than 10 times more likely than the lowest weight loss group to stay in the study until week 40. The medium weight loss group was more than 4 times more likely to stay in the study until week 40. Losing weight early in a program can serve as motivation to stay in the program longer, even if success begins to waiver over time.

Examining success in the current study population, this researcher again saw a similar finding. Compared with the group that lost the least amount of weight at week 5, the group that lost the greatest amount of weight at week 5 was also 10 times more likely to lose at least 5% of their weight at week 40.

The next variable examined was weight loss goals set at baseline. As discussed earlier, many patients tend to set overly ambitious weight loss goals (Wadden et al., 2003), and when

they are unable to reach these goals, they can become discouraged and will sometimes give up (Teixeira et al., 2002). The current study did not find any significant decrease in attrition when comparing subjects who set low early weight loss goals compared with subjects who set high early weight loss goals. There were consistent results when comparing success rates in this population. Setting ambitious or reasonable goals for weight loss did not significantly predict success or attrition in this sample. This may not be due to the lack of a correlation, but might instead attributed to the limited data from the small sample size. Because of the small sample size in the study, in order to achieve an even spread within each tertile, there was only a ~8% difference in weight goals between the lowest tertile of expected weight loss and the highest tertile. This small spread and limited sample reduced the power of the analysis and may have contributed to the null finding. It should also be noted that the category thresholds used in this study were somewhat generous. In order to achieve a normal spread of data, cutoffs were set at 20%, 30%, and 30+%, respectively; however, 5-10% is typically reasonable, 10-20% is ambitious and 20+% is very ambitious. However, breaking up groups in this manner was not possible due to left skewing in the distribution of expectations.

The third hypothesis of self-esteem's effect on success and attrition was also unsupported statistically. In this study, the subject's self-report of self-esteem did not appear to affect their levels of attrition or success in the study. Again, this may have been the result of the small sample size in the study. Only 8 subjects self- reported having low self-esteem and 45 reported high self-esteem (with the rest reporting "mixed self-esteem").

Because of the changes in appetite that can result from altering diabetes medication, many patients with diabetes experience a decreased perception of control over their weight loss. This perceived loss of control may lead to feelings of helplessness or hopelessness in their ability

to lose weight. These feelings of hopelessness or helplessness will at times cloud the picture of self-esteem and the way in which patients with type 2 diabetes see their ability to lose weight (Delahanty et al., 2007). These patients may also blame themselves for their diabetes, leading to more negative feelings and decreased self-esteem.

Another explanation of the reason why self-esteem may not have had a significant effect on this sample is that self-esteem was measured at baseline but was not continuously monitored throughout the study. If a subject initially rated himself or herself as having low self-esteem, but then began to see success in his or her weight loss, the rating of self-esteem may have improved dramatically (with the opposite occurring for patients who gained weight). Because self-esteem was not measured consistently throughout the study, it was impossible to see if this effect was true or not and therefore this may be an error both in measurement and in theory.

Finally, the fourth hypothesis measuring weight-related quality of life also failed to show significant results. In this hypothesis, this researcher examined how impaired quality of life may influence attrition and may influence success in weight reduction. Impaired quality of life failed to significantly predict success and attrition in this population. This may have been due to an error in measurement (this will be discussed later) or in calculating the actual impairment in quality of life. In the current study, quality of life was determined by norming the IWQOL-Lite data and using the group that fell one standard deviation above the norm as the impaired group. Typically, patients who already experience the negative effects of type 2 diabetes report a lower quality of life. This sample may not have been representative of a typical diabetic sample because the level of impairment is lower than what has been seen in other studies. Kolotkin & Crosby (2002) looked at the IWQOL-Lite data in a community sample and found that the mean level of impairment was 52.2 with a standard deviation of ±21.3. These numbers were obtained

from a community sample of obese patients seeking treatment in which the mean BMI = 27.4 and the mean age was 38.1. In the current study sample, the mean age was 52, mean BMI = 36.27, and mean IWQOL-Lite score was 62.01 ± 22.16. Because a positive linear relationship exists between quality of life, age, and BMI, it is expected that the current sample would report a lower quality of life, exceeding the rating seen in the current sample. It should also be noted that the sample used in the Kolotkin & Crosby (2002) study was not taken from a diabetic population. The fact that the current sample did not significantly differ in terms of quality of life scores despite the fact that the subjects were older, reported higher BMIs, and were also diagnosed with diabetes shows that the current study sample may not accurately reflect the impairment typically seen in an obese type 2 diabetic population. One reason that the current study sample may not have accurately reflected the true level of impairment that is typically seen may be due to selection bias, because subjects were not included in the study if their weight exceeded 300lb, had uncontrolled medical issues, or significant psychological problems. Significantly, there was also the possibility of a certain level of self-selection because patients were told before the study began that they were expected to exercise and follow an eating program with no monetary compensation. Statistically, only 18 people fell into the impaired quality of life category (22.8%); this may not have been a large enough sample size to see significant results.

The results of this study demonstrate the fact that there continues to be a lot of variability in the factors that can predict success and attrition in lifestyle modification programs with overweight and obese patients. These results mirror past research findings that patients with type 2 diabetes do not appear to differ significantly from patients without type 2 diabetes, and the same inconsistent findings that are seen in the general obese population also appear in this

population. Of note, many of the null results in this study may be attributed to small population size and weak statistical power.

The current study succeeded in replicating the finding that early weight loss may increase motivation and lead to patients staying in the treatment longer and experiencing greater success. However, this study failed to reveal an increase in odds when examining self-esteem, weight loss goals, and quality of life.

Integration of findings with past literature

The significant relationships between early weight loss and increased success and decreased attrition that were found in this study converged with much of the existing data on weight loss. This finding was not surprising because it mirrored past results by Fabricatore, 2007; Gucciardi, Demelo, Offenheim, & Stewart, 2008, who saw that low early weight loss often led to early attrition from weight reduction programs. This finding suggests that patients with type 2 diabetes may also benefit from early success in their program and that they will be driven by the same factors as the non-diabetic population. This convergence of the current research with past findings is also reflected in the null findings on many of the other variables. Obesity research has shown inconsistent findings in predicting success and attrition with this population and it is not surprising that this study produced the same results. Because this is only an early snapshot of how the type 2 diabetic population may compare with the general obesity population, these early findings do contribute to the literature in the ways in which these two populations may not differ significantly in what works and what does not work in lifestyle modification programs.

Implications of Findings

Although the results of several analyses did not support rejection of the null hypothesis, the finding that early weight loss did significantly predict a decrease in attrition and an increase in success in the obese type 2 diabetic population is promising. This discovery will allow researchers and clinicians to encourage early success in studies (as opposed to concentrating only on long term loss) and also provide additional support to patients who are struggling early in the program. Researchers may also increase support by making specific changes, or may encourage participants to focus on the task of weight loss instead of focusing on the weight loss numbers in order to prevent patients from becoming discouraged and abandoning their efforts. Demonstrating that the type 2 diabetes population may respond similarly to early success just as the non-type 2 diabetic population means that treatment providers can continue to work with both of these populations simultaneously and may not need to provide separate protocols when treating individuals with and without type 2 diabetes.

In the expected weight loss group, the null finding may also be attributed to actual non-significant predictive value with this population. In the type 2 diabetic population, changes in medication can often lead to changes in weight and appetite (Anthony et al., 2006). This population may therefore be immune to the effects of goal setting because of lowered expectations of success due to a history of medication changes affecting their success and failure (Looker, Knowler, & Hanson, 2001). The type 2 diabetes population may experience a type of "learned helplessness" over their treatment which can adversely affect their self-esteem and self-efficacy. If this does, in fact, become the case, programs treating the obese type 2 diabetic population may find more success by focusing on the history of medication treatment, past dieting history, attitude toward weight loss, and other social influences to conceptualize the

patient's schema. By obtaining this schema information, programs are well-situated to educate patients and to examine accurate expectations when setting long and short-term goals in order to provide more positive feedback, and instill hope, when necessary.

Limitations

There were many limitations in this study; specifically, that this researcher used an archival data set and was therefore limited to the data collected at baseline. If more precise measures for quality of life, self-esteem, and expected weight loss were used, it may have added significantly to the information and more accurately determined underlying differences in this population.

The self-esteem measurement in this study relied on one self-report question in the WALI (Wadden & Foster, 2003). Participants may have been unwilling to divulge their negative self-image due to embarrassment or fear that it could disqualify them from the study. As referenced earlier, the patient's motivation may actually change throughout the study as they fail or as they succeed in losing weight and controlling their diabetes, thus confirming or challenging their current self-image. Individuals who initially rated themselves as having poor or even mixed self-esteem may have some initial success in the treatment and suddenly began feeling more confident and had improved self-efficacy. Unfortunately, in this study they would still stay classified in the "poor self-esteem" group despite the fact that their subjective self-esteem rating may have changed. This data point could have been improved by comparing changes in subjective self-esteem ratings over time, but because these ratings were never collected, it was not possible to dissect from the data. This is not suggesting that actual self-esteem may have changed because of the weight loss, but that their subjective measurement may have changed. This error in measurement may have also occurred when examining weight-related quality of

life. As mentioned earlier, ratings of self-esteem and quality of life may change depending on success or failure in following a program. Using standardized scores may have shown a different result, but because of the limited sample size and variability of the dataset, testing this was not possible.

The second major limitation to this study was the relatively small number of subjects enrolled in the original study (N = 79). This significantly reduced the power of the statistical analyses required and made finding significance more difficult. Although many of the results came close to being significant, the limited number of subjects may have interfered. The statistical power as related to the limited sample size will be covered later in this section.

Another limitation was the number of self-report scales used in the study. Although it appears that there was a significant spread in the data gathered (self-reported self-esteem, Quality of Life, and Expected Weight Loss), these were also the 3 hypotheses that did not show significant results. Subjects may sometimes over-report symptoms to make themselves more eligible for studies or even under-report to prevent disqualification from studies. In measuring attrition, Fabricatore et al. (2011) attempted to follow up with reasons for attrition. This attrition data were not explored because it was outside the scope of this study. It is possible that many people did not drop out of the study for issues related to motivation or to being unhappy with their progress. It is possible that some people may have left early if they had lost an acceptable amount of weight and were happy with their early results. These subjects would have been captured in the measurement of success because of using the "last weight carried forward" approach in the study, but they still would have been counted as dropping out of the study before 40 weeks.

Finally, the statistical analysis used in the study has its own set of problematic issues due to the relatively limited sample size. Nemes, Jonasson, Genell, and Steineck (2009) found that many times, the odds ratios calculated by logistic regression analysis tend to be inflated when using small sample sizes in studies. Although there was a fairly even distribution when separating the data into tertiles in order to run the logistic regression analysis, there was still a limited amount of data to start with and therefore each tertile ended by being very small. The fact that the sample was small reduced the confidence and accuracy in the estimates.

Future Directions

Future study should continue to target specific differences and challenges that diabetes may present for patients attempting to lose weight or to engage in other lifestyle modification programs. Further exploration of cognitive and behavioral influences to attrition and success will be needed. Cognitive factors such as understanding of the illness, internal thought processes, feelings of helplessness, and hopelessness for change may aid researchers in predicting attrition and success with this population. Behavioral factors such as previous dieting attempts, dietary behaviors, medications, and number of support systems may also increase knowledge and aid researchers in designing programs that will be more successful in treating this population. Because this research was done with a limited population size, recreating the current study with a focus on a larger and more diverse subject pool may result in more positive and significant findings. Researchers should proceed to explore the many different factors leading to success and attrition in lifestyle modification programs designed for weight reduction because this problem continues to grow and affect the health and life quality of those suffering from obesity and from obesity-related illnesses such as diabetes.

References

American Dietetic Association. (2010). *Back to basics for healthy weight loss*. Retrieved April 22, 2010, from http://www.eatright.org/public/content.aspx?id=6847

Anderson, J. W., Kendall, C. W., & Jenkins, D. J. (2003). Importance of weight management in type 2 diabetes: Review with Meta-analysis of clinical studies. *Journal of the American College of Nutrition, 22*(5), 331-339.

Anderson, J. W., Kendall, C. W., & Jenkins, D. J. (2003). Importance of weight management in type 2 diabetes: Review with meta-analysis of clinical studies. *Journal of the American College of Nutrition, 22,* 331-339.

Anthony, K., Reed, L. J., Dunn, J. T., Bingham, E., Hopkins, D., Marsden, P. K., et al. (2006). Attenuation of insulin-evoked responses in brain networks controlling appetite and reward in insulin resistance: the cerebral basis for impaired control of food intake in metabolic syndrome? *Diabetes, 55*(11), 2986-2992.

Anton, S. D., Martin, C. K., Redman, L., York-Crowe, E., Heilbronn, L. K., Han, H., et al. (2008). Psychosocial and behavioral pre-treatment predictors of weight loss outcomes. *Eating and Weight Disorders, 13*, 30-37.

Barsh, G. S., Farooqi, I. S., & O'Rahilly, S. (2000). Genetics of body-weight regulation. *Nature, 404,* 644-651.

Bellisari, A. (2008). Evolutionary origins of obesity. *Obesity Reviews, 9,* 165-180.

Bernier, M., & Avard, J. (1986). Self-efficacy, outcome, and attrition in a weight-reduction program. *Cognitive Therapy and Research, 10*(3), 319-338.

Birch, L. L., & Anzman, S. L. (2009). Learning to eat in an obesogenic environment: A developmental systems perspective on childhood obesity. *Research in Child Development, 4*(2), 138-142.

Blackburn, G. L. (1995). Effect of degree of weight loss on health benefits. *Obesity Research, 3,* 211S-216S.

Blackburn, G. L., Hu, F. B., & Hutter, M. M. (2009). Updated evidence-based recommendations for best practices in weight loss surgery. *Obesity, 17*(5), 839-841.

Brand-Miller, J., Hayne, S., Petocz, P., & Colagiuri, S. (2003). Low-glycemic index diets in the management of diabetes: A meta-analysis of randomized controlled trials. *Diabetes Care, 26*(8), 2261-2267.

Carels, R. A., Cacciapaglia, H. M., Douglass, O. M., Rydin, S., & O'Brian, W. H. (2003). The early identification of poor treatment outcome in a women's weight loss program. *Eating Behaviors, 4,* 265-282.

Centers For Disease Control And Prevention (2008). National diabetes fact sheet: general information and national estimates on diabetes in the United States, 2007. In (p.). U.S. Department of Health and Human Services: Center for Disease Control and Prevention.

Centers For Disease Control And Prevention. (2009). *About BMI for Adults*. Retrieved April 11, 2010, from Centers for Disease Control and Prevention Web site: http://http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html#Interpreted

Centers For Disease Control And Prevention. (2009). *Overweight and Obesity*. Retrieved April 11, 2010, from Centers for Disease Control and Prevention Web site: http://www.cdc.gov/obesity/defining.html

Clark, M. M., Niaura, R., King, T. K., & Pera, V. (1996). Depression, smoking, activity level, and health status: Pretreatment predictors of attrition in obesity treatment. *Addictive Behaviors, 21*(4), 509-513.

Cramer, P., & Steinwert, T. (1998). Thin is good, fat is bad: how early dies it begin? *Joural of Applied Developmental Psychology, 19,* 429-451.

Delahanty, L. M., Grant, R. W., Wittenberg, E., Bosch, J. L., Wexler, D. J., Cagliero, E., et al. (2007). Association of diabetes-related emotional distress with diabetes treatment in primary care patients with Type 2 diabetes. *Diabetic Medicine, 24,* 48-54.

Delahanty, L. M., & Nathan, D. M. (2008). Implications of the Diabetes Prevention Program (DPP) and Look AHEAD clinical trials for lifestyle interventions. *Journal of the American Dietetic Association, 108*(4 Suppl 1), S66-S72.

Dellavigna, S., & Malmendier, U. (2006). Paying not to go to the gym. *The American Economic Review, 96*(3), 694-719.

Dennis, K. E., & Goldberg, A. P. (1996). Weight control self-efficacy types and transitions affect weight-loss outcomes in obese women. *Addictive Behaviors, 21*(1), 103-116.

Dixon, J. B., Dixon, M. E., & O'Brien, P. E. (2003). Depression in association with severe obesity. *Archives of Internal Medicine, 163,* 2058-2065.

Donnelly, J. E., & Smith, B. K. (2005). Is exercise effective for weight loss with ad libitum diet? Energy balance, compensation, and gender differences. *Exercise & Sport Sciences Reviews, 33*(4), 169-174.

Dumanovsky, T., Nonas, C. A., Huang, C. Y., Silver, L. D., & Bassett, M. T. (2009). What people buy from fast-food restaurants: caloric content and menu item selection, New York City 2007. *Obesity, 17*(7), 1369-1374.

Elder, S. J., & Roberts, S. B. (2007). The effects of exercise on food intake and body fatness: A summary of published studies. *Nutrition Reviews, 65*(1), 1-19.

Everson, S. A., Maty, S. C., Lynch, J. W., & Kaplan, G. A. (2002). Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *Journal of Psychosomatic Research, 53,* 891-895.

Fabricatore, A. N. (2007). Behavior Therapy and Cognitive-Behavioral Therapy of obesity: Is there a difference? *Journal of the American Dietetic Association, 107*(1), 92-98.

Fabricatore, A. N., & Wadden, T. A. (2003). Psychological functioning of obese individuals. *Diabetes Spectrum, 16*(4), 245-252.

Fabricatore, A. N., Wadden, T. A., Ebbeling, C. B., Thomas, J. G., Stallings, V. A., Schwartz, S., et al. (2011). Targeting dietary fat or glycemic load in the treatment of obesity and type 2 diabetes: A randomized controlled trial. *Diabetes Research and Clinical Practice, 92,* 37-45.

Fabricatore, A. N., Wadden, T. A., Moore, R. H., Butryn, M. L., Gravallese, E. A., Erondu, N. E., et al. (2009). Attrition from randomized controlled trials of pharmacological weight loss agents: a systematic review and analysis. *Obesity Reviews, 10*(3), 333-341.

Fabricatore, A. N., Wadden, T. A., Moore, R. H., Butryn, M. L., Heymsfield, S. B., & Nguyen, A. M. (2009). Predictors of attrition and weight loss success: Results from a randomized controlled trial. *Behaviour Research and Therapy, 47,* 685-691.

Fabricatore, A. N., Wadden, T. A., Womble, L. G., Sarwer, D. B., Berkowitz, R. I., Foster, G. D., et al. (2007). The role of patients' expectations and goals in the behavioral and pharmacological treatment of obesity. *International Journal of Obesity, 31,* 1739-1745.

Farooqi, I. S., & O'Rahilly, S. (2007). Genetic factors in human obesity. *Obesity Reviews, 8*(Suppl. 1), 37-40.

Finkelstein, E. A., Fiebelkorn, I. C., & Wang, G. (2003). National medical spending attributable to overweight and obesity: how much, and who's paying? *Health Affairs, 22*(3), 219-226.

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer-and service-specific estimates. *Health Affairs, 28*(5), w822-w831.

Fontaine, K. R., Bartlett, S. J., & Barofsky, I. (1998). Health-related quality of life among obese persons seeking and not currently seeking treatment. *International Journal of Eating Disorders, 27*(1), 101-105.

Fossa, S. D., & Dahl, A. A. (2002). Short Form 36 and Hospital Anxiety and Depression Scale. A comparison based on patients with testicular cancer. *Journal of Psychosomatic Research, 52,* 79-87.

Foster, G. D. (2006). Clinical implications for the treatment of obesity. *Obesity, 14*(Suppl 4), 182S-185S.

Foster, G. D., Makris, A. P., & Bailer, B. A. (2005). Behavioral treatment of obesity. *American Journal of Clinical Nutrition, 82*((suppl)), 230S-235S.

Foster, G. D., Wadden, T. A., Vogt, R. A., & Brewer, G. (1997). What is reasonable weight loss? Patients' expectations and evaluations of obesity treatment outcomes. *Journal of Consulting and Clinical Psychology, 65*(1), 79-85.

Garb, J., Welch, G., Zagaris, S., Kuhn, J., & Romanelli, J. (2009). Bariatric surgery for the treatment of morbid obesity: A meta-analysis of weight loss outcomes for laparoscopic adjustable gastric banding and laparoscopic gastric bypass. *Obesity Surgery, 19,* 1447-1455.

Golay, A., & Ybarra, J. (2005). Link between obesity and type 2 diabetes. *Best Practice & Research Clinical Endocrinology & Metabolism, 19*(4), 649-663.

Grave, R. D., Calugi, S., Magri, F., Cuzzolaro, M., Dall'Aglio, E., Lucchin, L., et al. (2004). Weight loss expectations in obese patients seeking treatment at medical centers. *Obesity Research, 12*(12), 2005-2012.

Grave, R. D., Calugi, S., Molinari, E., Petroni, M. L., Bondi, M., Compare, A., et al. (2005). Weight loss expectations in obese patients and treatment attrition: An observational multicenter study. *Obesity Research, 13*(11), 1961-1969.

Grossi, E., Grave, D. R., Manucci, E., Molinari, E., Compare, A., Cozzolaro, M., et al. (2006). Complexity of attrition in the treatment of obesity: clues from a structured telephone interview. *International Journal of Obesity, 30,* 1132-1137.

Gucciardi, E., Demelo, M., Offenheim, A., & Stewart, D. E. (2008). Factors contributing to attrition behavior in diabetes self-management programs: a mixed method approach. *BMC Health Services Research, 8*(33), 1-11.

Han, T. S., Tijhuis, A. R., Lean, M. E., & Seidell, J. C. (1998). Quality of life in relation to overweight and body fat distribution. *American Journal of Public Health, 88*(12), 1814-1820.

Heshka, S., Anderson, J. W., Atkinson, R. L., Greenway, F. L., Hill, J. O., Phinney, S. D., et al. (2003). Weight loss with self-help compared with a structured commercial program. *JAMA, 289*(14), 1792-1798.

Honas, J. J., Early, J. L., Frederickson, D. D., & O'Brian, M. S. (2003). Predictors of attrition in a large clinic-based weight-loss program. *Obesity Research, 11*(7), 888-894.

Hope, A. A., Kumanyika, S. K., Whitt, M. C., & Shults, J. (2005). Obesity-related comorbidities in obese African Americans in an outpatient weight loss program. *Obesity Research, 13*, 772-779.

Huisman, S., Maes, S., Degucht, V. J., Chatrou, M., & Haak, H. R. (2009). Low goal ownership predicts drop-out from a weight intervention study in overweight patients with type 2 diabetes. *International Journal of Behavioral Medicine, , .* doi:10.1007/s12529-009-9071-3

Inelmen, E. M., Toffanello, E. D., Enzi, G., Gasparini, G., Miotto, F., Sergi, G., et al. (2005). Predictors of drop-out in overweight and obese outpatients. *International Journal of Obesity, 29,* 122-128.

Jeffery, R. W., Wing, R. R., & Mayer, R. R. (1998). Are smaller weight losses or more achievable weight loss goals better in the long term for obese patients? *Journal of Consulting and Clinical Psychology, 66*(4), 641-645.

Johnston, C. S., Day, C. S., & Swan, P. D. (2002). Postprandial thermogenesis is increased 100% on a high-protein, low-fat diet versus a high-carbohydrate, low-fat diet in healthy, young women. *Journal of American College of Nutrition, 21*(1), 55-61.

Klein, S., Sheard, N. F., Pi-Sunyer, X., Daly, A., Wylie-Rosett, J., Kulkarni, K., et al. (2004). Weight management through lifestyle modification for the prevention and management of type 2 diabetes: Rationale and strategies. *Diabetes Care, 27*(8), 2067-2073.

Kolotkin, R. L., & Crosby, R. D. (2002). Psychometric evaluation of the impact of weight on quality of life-lite questionnaire (IWQOL-Lite) in a community sample. *Quality of Life Research, 11,* 157-171.

Kolotkin, R. L., Crosby, R. D., Kosloski, K. D., & Williams, G. R. (2001). Development of a brief measure to assess quality of life in obesity. *Obesity Research, 9*(2), 102-111.

Kolotkin, R. L., & Moore, J. M. (1983). Attrition in a behavioral weight-control program. A comparison of dropouts and completers. *International Journal of Eating Disorders, 2*(3), 93-100.

Kopelman, P. (2007). Health risks associated with overweight and obesity. *Obesity Reviews, 8,* 13-17.

Kramer, H., Cao, G., Dugas, L., Luke, A., Cooper, R., & Durazo-Arvizu, R. (2009). Increasing BMI and waist circumference and prevalence of obesity among adults with type 2 diabetes: the National Health and Nutrition Examination Surveys. *Journal of Diabetes and Its Complications, (in print).*

Kruger, J., Galuska, D. A., Serdula, M. K., & Jones, D. A. (2004). Attempting to lose weight: Specific practices among U.S. adults. *American Journal of Preventive Medicine, 26*(5), 402-406.

Looker, H. C., Knowler, W. C., & Hanson, R. L. (2001). Changes in BMI and weight before and after the development of type 2 diabetes. *Diabetes Care, 24,* 1917-1922.

Ma, Y., Olendzki, B. C., Merriam, P. A., Chiriboga, D. E., Culver, A. L., Li, W., et al. (2008). A randomized clinical trial comparing low-glycemic index versus ADA dietary education among individuals with type 2 diabetes. *Nutrition, 24*(1), 45-56.

Marti, A., Moreno-Aliaga, M. J., Hebebrand, J., & Martinez, J. A. (2004). Genes, lifestyles and obesity. *International Journal of Obesity, 28,* S29-S36.

Martin, C. K., O'Neil, P. M., & Binks, M. (2002). An attempt to identify predictors of treatment outcome in two comprehensive weight loss programs. *Eating Behaviors, 3,* 239-248.

Martinez, A. J. (2000). Body-weight regulation: causes of obesity. *Proceedings of the Nutrition Society, 59,* 337-345.

McAuley, K. A., Hopkins, C. M., Smith, K. J., McLay, R. T., Williams, S. M., Taylor, R. W., et al. (2005). Comparison of high-fat and high-protein diets with a high-carbohydrate diet in insulin-resistant obese women. *Diabetologia, 48,* 8-16.

McCormick, B. (2007). Economic costs of obesit and the case for government internvention. *Obesity Reviews, 8*(Suppl. 1), 161-164.

McElroy, S. L., Kotwal, R., Malhotra, S., Nelson, E. B., Keck, P. E., & Nemeroff, C. B. (2004). Are mood disorders and obesity related? A review for the mental health professional. *Journal of Clinical Psychiatry, 65*(5), 634-651.

McMillan-Price, J., Petocz, P., Atkinson, F., O'Neill, K., Samman, S., Steinbeck, K., et al. (2006). Comparison of 4 diets of varying glycemic load on weight loss and cardiovascular risk reduction in overweight and obese young adults: A randomized controlled trial. *Archives of Internal Medicine, 166,* 1466-1475.

Miller, C. T., & Downey, K. T. (1999). A meta-analysis of heavyweight and self-esteem. *Personality and Social Psychology Review, 3*(1), 68-84.

Mitchell, C., & Stuart, R. B. (1984). Effect of self-efficacy on dropout from obesity treatment. *Journal of Consulting and Clinical Psychology, 52*(6), 1100-1101.

Morris, S. (2007). The impact of obesity on employment. *Labour Economics, 14,* 413-433.

Murphy, J. M., Horton, N. J., Burke, J. D., Monson, R. R., Laird, N. M., Lesage, A., et al. (2009). Obesity and weight gain in relation to depression: findings from the Stirling County Study. *International Journal of Obesity, 33*(3), 335-341.

Nathan, D. M. (2002). Initial management of glycemia in type 2 diabetes mellitus. *New England Journal of Medicine, 347*(17), 1342-1349.

National Institute Of Health (2007). *USRDS 2007 Annual Data Report* (). Bethesda, MD: U.S. Department of Health and Human Services.

National Restaurant Association. (n.d.). *Healthy Dining Finder*. Retrieved April 24, 2010, from http://www.healthydiningfinder.com

Nemes, S., Jonasson, J. M., Genell, A., & Steineck, G. (2009). Bias in odds rations by logistic regression modeling and sample size. *BMC Medical Research Methodology, 9*(56), 1-5.

Nickel, M. K., Loew, T. H., & Bachler, E. (2007). Change in mental symptoms in extreme obesity patients after gastric banding part II: Six-year follow up. *International Journal of Psychiatry in Medicine, 37*(1), 69-79.

Nir, Z., & Neumann, L. (1995). Relationship among self-esteem, internal-external locus of control, and weight change after participation in a weight reduction program. *Journal of Clinical Psychology, 51,* 482-490.

Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *Journal of the American Medical Association, 295*(13), 1549-1555.

Perri, M. G., Nezu, A. M., Patti, E. T., & McCann, K. L. (1989). Effect of length of treatment on weight loss. *Journal of Consulting and Clinical Psychology, 57*(3), 450-452.

Pittas, A. G., Das, S. K., Hajduk, C. L., Golden, J., Saltzman, E., Stark, P. C., et al. (2005). A low-glycemic load diet facilitates greater weight loss in overweight adults with high insulin secretion but not in overweight adults with low insulin secretion in the CALERIE Trial. *Diabetes Care, 28*(12), 2939-2941.

Poston, W. S., & Foreyt, J. P. (1999). Obesity is an environmental issue. *Atherosclerosis, 146,* 210-209.

Puhl, R. M., & Heuer, C. A. (2009). The stigma of obesity: A review and update. *Obesity, 17*(5), 941-964.

Reidpath, D. D., Burns, C., Garrard, J., Mahoney, M., & Townsend, M. (2002). An ecological study of the relationship between social and environmental determinants of obesity. *Health & Place, 8,* 141-145.

Rennie, K. L., Johnson, L., & Jebb, S. A. (2005). Behavioural determinants of obesity. *Best Practice & Research Clinical Endocrinology & Metabolism, 19*(3), 343-358.

Riserus, U., Willett, W. C., & Hu, F. B. (2009). Dietary fats and prevention of type 2 diabetes. *Progress in Lipid Research, 48,* 44-51.

Robinson, T. N. (1998). Does television cause childhood obesity? *JAMA, 279*(12), 959-960.

Roehling, M. V., Roehling, P. V., & Pichler, S. (2007). The relationship between body weight and perceived weight-related employment discrimination: the role of sex and race. *Journal of Vocational Behavior, 71,* 300-318.

Roehrig, C., Miller, G., Lake, C., & Bryant, J. (2009). National health spending by medical condition, 1996-2005. *Health Affairs, 28*(2), w358-w367.

Ross, K. M., Milsom, V. A., Rickel, K. A., Debraganza, N., Gibbons, L. M., Murawski, M. E., et al. (2009). The contributions of weight loss and increased physical fitness to improvements in health-related quality of life. *Eating Behaviors, 10,* 84-88.

Ross, R., Dagnone, D., Jones, P. J., Smith, H., Paddags, A., Hudson, R., et al. (2000). Reduction in obesity and related comorbid conditions after diet-induced weight loss or exercise-induced weight loss in men. *Annals of Internal Medicine, 133,* 92-103.

Rothblum, E. D., Brand, P. A., Miller, B. C., & Oetjen, H. A. (1990). The relationship between obesity, employment, discrimination, and employment-related victimization. *Journal of Vocational Behavior, 37,* 251-266.

Sacks, F. M., Bray, G. A., Carey, V. J., Smith, S. R., Ryan, D. H., Anton, S. D., et al. (2009). Comparison of weight-loss diets with different compositions of fat, protein, and carbohydrates. *New England Journal of Medicine, 360*(9), 859-873.

Samaha, F. F., Iqbal, N., Seshadri, P., Chicano, K. L., Daily, D. A., McGrory, J., et al. (2003). A low-carbohydrate as compared with a low-fat diet in severe obesity. *The New England Journal of Medicine, 348*(21), 2074-2081.

Schowlter, M., Benecke, A., Lager, C., Heimbucher, J., Bueter, M., Thalheimer, A., et al. (2008). Changes in depression following gastric banding: A 5- to 7- year prospective study. *Obesity Surgery, 18,* 314-320.

Schwimmer, J. B., Burwinkle, T. M., & Varni, J. W. (2003). Health-related quality of life of severely obese children and adolescents. *JAMA, 289*(14), 1813-1819.

Sheard, N. F., Clark, N. G., Brand-Miller, J. C., Franz, M. J., Pi-Sunyer, F. X., Mayer-Davis, E., et al. (2004). Dietary carbohydrate (amount and type) in the prevention and management of diabetes. *Diabetes Care, 27*(9), 2266-2271.

Sorensen, T. I., Price, R. A., Stunkard, A. J., & Schulsinger, F. (1989). Genetics of obesity in adult adoptees and their biological siblings. *British Medical Journal, 298,* 87-90.

Speakman, J. R. (2007). Genetics of obesity. Five fundamental problems with the famine hypothesis. In G. Fantuzzi & T. Mazzone (Eds.), *Adipose tissue and adipokines in health and disease nutrition and health* (4th ed., Rev., pp. 221-236). Totowa, NJ: Humana Press Inc.

Stunkard, A. J., Faith, M. S., & Allison, K. C. (2003). Depression and obesity. *Society of Biological Psychiatry, 54,* 330-337.

Swinburn, B., Egger, G., & Raza, F. (1999). Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. *Preventive Medicine, 29,* 563-570.

Teixeira, P. J., Going, S. B., Houtkooper, L. B., Cussler, E. C., Martin, C. J., Metcalfe, L. L., et al. (2002). Weight loss readiness in middle-aged women: Psychosocial predictors of success for behavioral weight reduction. *Journal of Behavioral Medicine, 25*(6), 499-523.

Teixeira, P. J., Going, S. B., Houtkooper, L. B., Cussler, E. C., Metcalfe, L. L., Blew, R. M., et al. (2004). Pretreatment predictors of attrition and successful weight management in women. *International Journal of Obesity, 28,* 1124-1133.

Teixeira, P. J., Going, S. B., Sardinha, L. B., & Lohman, T. G. (2005). A review of psychosocial pre-treatment predictors of weight control. *Obesity Reviews, 6,* 43-65.

Teixeira, P. J., Palmeira , A. L., Branco, T. L., Martins, S. S., Minderico, C. S., Barata, J. T., et al. (2004). Who will lose weight? A reexamination of predictors of weight loss in women. *International Journal of Behavioral Nutrition and Physical Activity, 1,* 1-12.

Testa, M. A., & Simonson, D. C. (1996). Assessment of quality-of-life outcomes. *The New England Journal of Medicine, 334*(13), 835-840.

Tsai, A. G., Williamson, D. F., & Glick, H. A. (2010). Direct medical cost of overweight and obesity in the USA: a quantitative systematic review. *Obesity Reviews, 11*(6), 1-12.

Volkmar, F. R., Stunkard, A. J., Woolston, J., & Bailey, R. A. (1981). High attrition rates in commercial weight reduction programs. *Archives of Internal Medicine, 141,* 426-428.

Wadden, T. A., Butryn, M. L., & Byrne, K. J. (2004). Efficacy of lifestyle modification for long-term weight control. *Obesity Research, 12,* 151S-162S.

Wadden, T. A., Butryn, M. L., Sarwer, D. B., Fabricatore, A. N., Crerand, C. E., Lipschutz, P. E., et al. (2006). Comparison of psychosocial status in treatment-seeking women with class III vs. class I-II obesity. *Obesity, 14*(Suppl 2), 90S-98S.

Wadden, T. A., & Foster, G. D. (2003). Weight and lifestyle inventory (WALI). *Surgery for Obesity and Related Diseases, 2,* 180-199.

Wadden, T. A., Foster, G. D., Letizia, K. A., & Stunkard, A. J. (1992). A multicenter evaluation of a proprietary weight reduction program for the treatment of marked obesity. *Archives of Internal Medicine, 152,* 961-966.

Wadden, T. A., Foster, G. D., Wang, J., Pierson, R. N., Yang, M. U., Moreland, K., et al. (1992). Clinical correlates of short and long term weight loss. *American Journal of Clinical Nutrition, 56*(27), 1S - 4S.

Wadden, T. A., & Phelan, S. (2002). Assessment of quality of life in obese individuals. *Obesity Research, 10,* 50s-57s.

Wadden , T. A., West, D. S., Neiberg, R., Wing, R. R., Ryan, D. H., Johnson, K. C., et al. (2009). One-year weight losses in the Look AHEAD study: Factors associated with success. *Obesity, 17*(4), 713-722.

Wadden, T. A., Womble, L. G., Sarwer, D. B., Berkowitz, R. I., Clark, V. L., & Foster, G. D. (2003). Great expectations: "Im losing 25% of my weight no matter what you say". *Journal of Consulting and Clinical Psychology, 71*(6), 1084-1089.

Wardle, Jane, & Cooke, Lucy (2005). The impact of obesity on psychological well-being. *Best Practices & Research Clinical Endocrinology & Metabolism, 19*(3), 421-440.

Ware, J. E., Snow, K. K., Kosinski, M., & Gandek, B. (1993). *SF-36 health survey: Manual and interpretation guide*. Boston: The Health Institute, New England Medical Center.

Wild, S., Roglic, G., Green, A., Sicree, R., & King, H. (2004). Global prevalence of diabetes. Estimates for the year 2000 and projections for 2030. *Diabetes Care, 27,* 1047-1053.

Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight loss maintenance. *Journal of Personality and Social Psychology, 70*(1), 115-126.

Wolever, T. M., Jenkins, D. J., Jenkins, A. L., & Josse, R. G. (1991). The glycemic index: methodology and clinical implications. *American Journal of Clinical Nutrition, 54,* 846-854.

World Health Organization (1999). Definition, diagnosis and classification of diabetes mellitus and its complications; Report of a WHO consultation. *World Health Organization Department of Noncommunicable Disease Surveillance*.

Yancy, W. S., Olsen, M. K., Guyton, J. R., Bakst, R. P., & Westman, E. C. (2004). A low-carbohydrate, ketogenic diet versus a low-fat diet to treat obesity and hyperlipidemia. *Annals of Internal Medicine, 140,* 769-777.

Yass-Reed, E. M., Barry, N. J., & Dacey, C. M. (1993). Examination of pretreatment predictors of attrition in a VLCD and behavior therapy weight-loss program. *Addictive Behaviors, 18,* 431-435.

Zimmet, P., Alberti, K. G., & Shaw, J. (2001). Global and societal implications of the diabetes epidemic. *Nature, 414,* 782-787.